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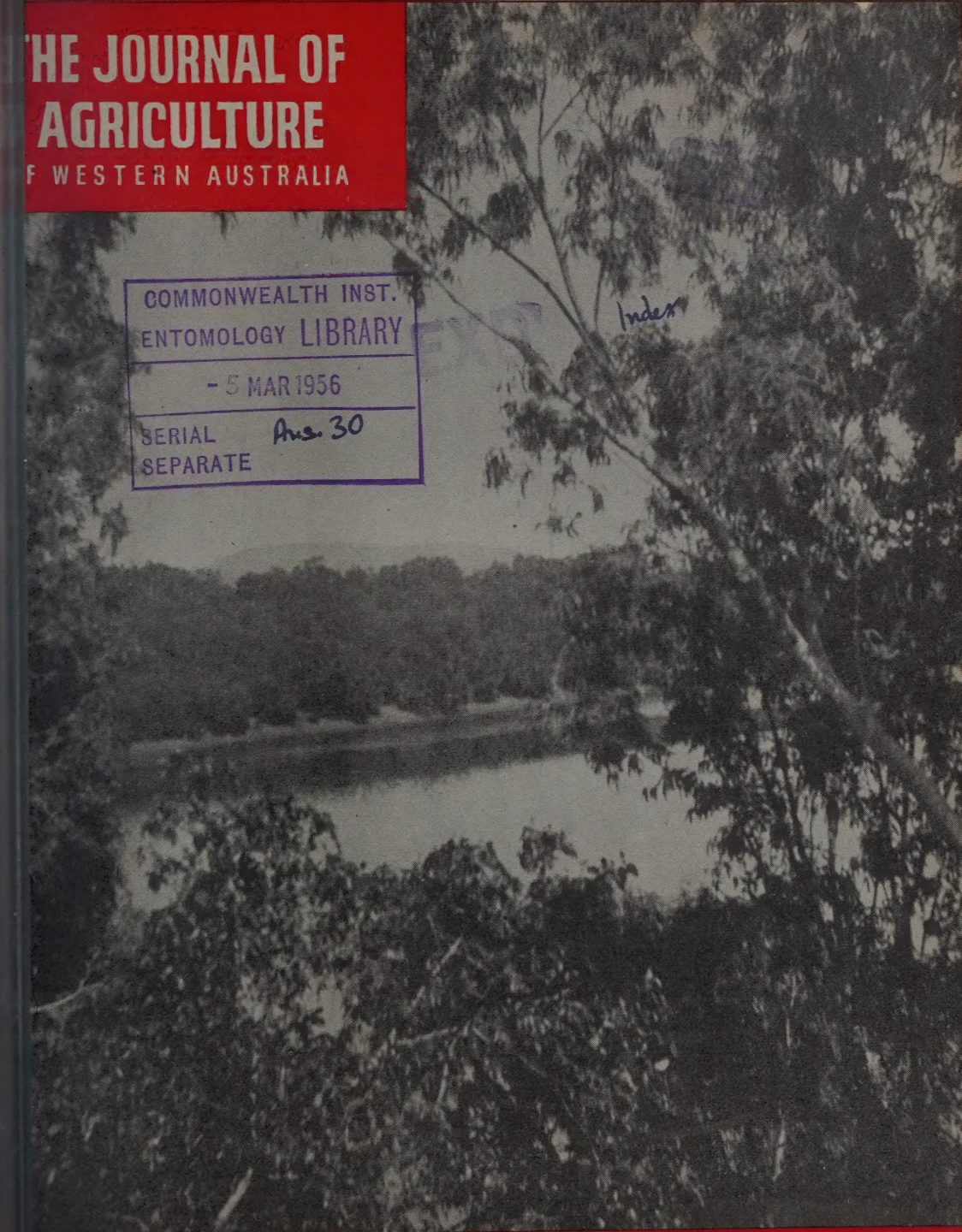

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The JOURNAL OF THE DEPARTMENT OF AGRICULTURE
WESTERN AUSTRALIA

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COVER PICTURE

A foliage-framed glimpse of the Ord River at Carlton Reach, East Kimberley. By the construction of a dam across the Ord River where it passes through a gorge in the Carr Boyd Ranges, it is envisaged that large areas of blacksoil plain could be irrigated for tropical agriculture

IN THIS ISSUE

The Pruning of Fruit Trees—Part 3 (continued) H. R. Powell 645

A Roving Field Day 669

New Host Records for the Mediterranean Fruit Fly in W.A. C. F. H. Jenkins 673

Pedigree Seed—Wheat, Oats and Barley 675

Rules of the W.A. Official Pure Bred Dairy Cattle Production Recording Scheme 677

Changes in Pastoral Vegetation can Provide a Guide to Management .... H. Suijdendorp 683

Trapping Yards for Kangaroos C. D. Gooding and L. A. Harrison 689

Sturt Peas for Your Garden .... F. Bridgman 697

Books for Farmers 703

Weeds of Western Australia—Geraldton Carnation Weed G. R. W. Meadly 705

Raising Turkeys .... S. Froome 709

The Handling, Presentation and Storing of Stone Fruit F. Melville and J. S. Bloomfield 737

Paratyphoid (Salmonellosis) in Sheep .... C. R. Toop 749

Rabbit Damage to Pastures .... C. D. Gooding 753

A Simple Aid to Footrot Control .... J. A. Mallett 757

Index to 1955 Volume 761

Sunrise and Sunset Tables 768

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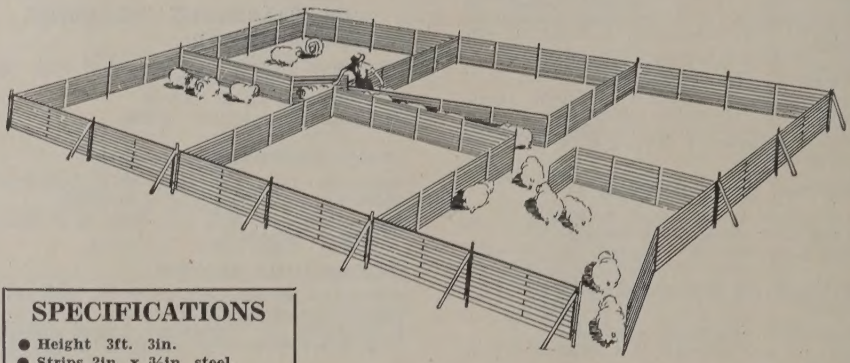

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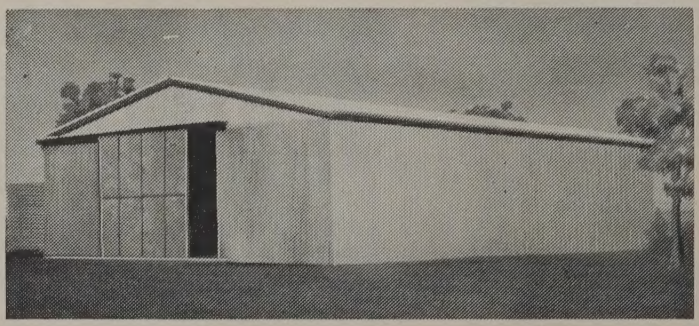

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THE PRUNING OF FRUIT TREES

By H. R. POWELL, B.Sc. (Agric.), Superintendent of Horticulture

PART 3 (contd.)—DECIDUOUS FRUIT TREES (APPLES)

THE commercial varieties of apples grown in Western Australia, are restricted in the main to Granny Smith, Cleopatra, Dunn's Seedling, Jonathan, Yates, Dougherty, Rokewood and Delicious. Other varieties such as Democrats, Rome Beauty, Williams Favourite, Lord Nelson and Golden Delicious, etc., are grown, but plantings are on a relatively small scale.

Varieties of apples differ in their habits of growth; some are upright growers and others are of a more spreading habit, and these natural characteristics must be taken into consideration when the trees are pruned, as explained in Part 2.

Systems of pruning vary a great deal. Originally in this State, apple trees were heavily "spur" pruned, that is to say the one-year-old laterals were cut back to three or four buds at each pruning. This system has gradually given way to "lateral" pruning due to a large extent to the teachings of the late G. W. Wickens, formerly Superintendent of Horticulture in this Department.

In 1939 the Wickens system of pruning which included, among other features, the non-tipping of leaders, was introduced but unfortunately the system, though widely adopted for a number of years, was not generally understood and is now rarely used. (See Part 1, and Figs. 32, 33 and 98.)

Fig. 68.—A pruning discussion on Mr. R. Grist's orchard at Donnybrook. (Left to right) R. Grist, Inspector N. A. G. Brockman, the author, and Mr. R. L. Cailes, Horticultural Instructor. The tree is a 24-year-old Yates with good framework and lateral development. Coloured varieties need wider spacing of the leaders than do green varieties for the reason that more light is required in the centre and lower portions of the tree to bring out the characteristic colour of the fruit.

In Parts 1 and 2, the beneficial features of this system have been incorporated in the advice given, particularly with regard to the retention of untipped leaders on weak sides of uneven trees, (Fig. 12), on strong-growing trees (Fig. 29), and on leaders making weak growth or affect with die-back (Figs. 71 and 93.)

The number of leaders retained on a mature apple tree usually varies between

10 and 16, depending upon the habit of growth of the variety, whether the variety is coloured or not, the vigour of individual trees, and the method of pruning used. Trees of upright-growing varieties require fewer leaders than do spreading types, and coloured varieties similarly require less leaders than green varieties of similar habit of growth for the reason that more light is required in the centre and lower portions of the tree to bring out the characteristic colour on the fruit. Obviously strong vigorous trees need more leaders than less vigorous trees of any given variety. The method of pruning used also has an important bearing on the number of leaders; as an example, trees trained on the Wickens system (Figs. 32, 33 and 98) have an inner and outer ring of leaders, and this method, modified by orthodox treatment of the leaders, is also fairly general in some districts (Figs. 80 and 81).

Fig. 69.—An outstanding tree 39 years old on the orchard of Mr. W. Parke, Donnybrook. It was originally a Jonathan, but was worked over to Granny Smith 12 years previously and the largest crop was 38 bushels. The framework and lateral development is very good.

THE ANNUAL WOOD GROWTH

The annual wood growth consists of water shoots, wood shoots, laterals, fruit spurs, leaf spurs, fruit twigs and leaf twigs. A general description of these parts was given in Part 1, and the treatment of wood shoots and water shoots was outlined in Part 2. As the laterals and spurs and other types of annual wood growth have specific functions on apple trees, some detailed knowledge of their structure and behaviour is necessary before the trees can be confidently pruned.

Water Shoots.—Strong vigorous growths arising from dormant buds. They are caused by too severe pruning treatments, and loss of leaders through breakages, etc.

Fig. 70.—A six-year-old Jonathan previously pruned too severely. Most of the annual growth consists of wood shoots which will have to be removed when the tree is pruned. See Fig. 71.

Wood Shoots.—These are strong growing shoots found on vigorous trees, usually arising from the topmost buds of leader extensions left at the last winter pruning. On severely pruned trees they can arise from any position on growth formed the previous season (Figs. 21 and 28).

Fig. 71.—The six-year-old Jonathan in Fig. 70 pruned. Current extensions to the leaders have been carefully chosen. One leader in the background, a weaker growth, has been left untipped to strengthen up. Horizontal laterals have been retained, care being taken that the topmost bud on any is not as high, or higher, than the topmost bud on the leader bearing it; the topmost bud even on a relatively weak shoot if left above the top of the leader can often make vigorous growth. This will result in the leader being "robbed." Other laterals on the current extension, being too upright, or too close together, have been cut back to the growth rings at their bases.

On the older extensions, as much horizontal growth, wood shoots and laterals, as possible, have been retained untipped. In some instances upright shoots have been tied down and in others, they have been shortened back (see text).

Laterals.—These are weaker-growing shoots and they arise from buds on the leader extensions, below those producting wood shoots. They are also found on other parts of the trees as well, on water shoots and wood shoots, on laterals formed the previous year, and on spur formations which have been stimulated into growth by pruning treatments (Figs. 83 and 89). On most trees there is a gradual transition from weak laterals to strong wood shoots. However, the term lateral usually refers to the more horizontal growth, and weak shoots growing either obliquely or vertically. They are well illustrated in Figs. 69, 72 and 85 as the side shoots clothing the leaders and sub-leaders.

As a general rule, laterals growing horizontally and obliquely are retained, whilst those growing vertically are suppressed or else "spurred" or shortened back to a few buds. The side buds are usually leaf buds, and the terminal bud can either be a leaf or a fruit bud. Often a number of the side or lateral buds on some varieties are fruit buds. The leaf buds are able to continue the vegetative growth of the lateral, and under conditions suitable for fruiting they give rise to fruit spurs, (Figs. 73, 75, 77 and 78). The fruit bud is usually much plumper

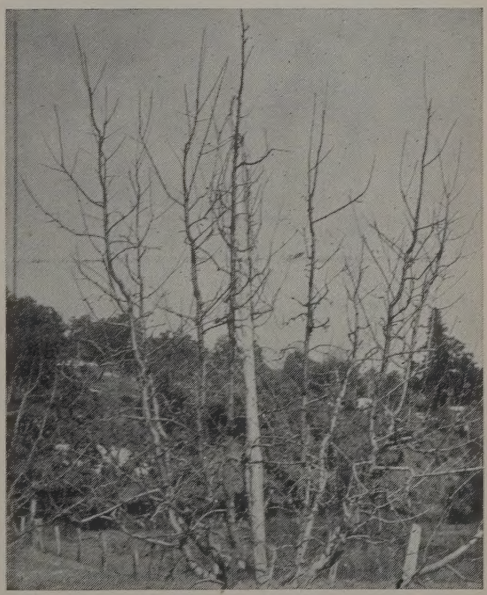

Fig. 72.—Lateral development on a 13-year-old unpruned Granny Smith.

It will be noticed that the laterals have been left long, particularly where sufficient room existed. Series of changes in the direction of growth, particularly noticeable on the outside leaders, indicate the extensions made previously; the pruning cuts were made to outside buds.

than the leaf bud, but there are occasions when it is impossible to distinguish between them. The leaf buds on most varieties are fairly uniformly developed along the entire length of the lateral, as with Cleopatras and Dunns; but on some varieties the buds towards the base of the lateral are not well-developed, as with Jonathans. Care should always be taken in shortening Jonathan laterals, to cut to a sound bud.

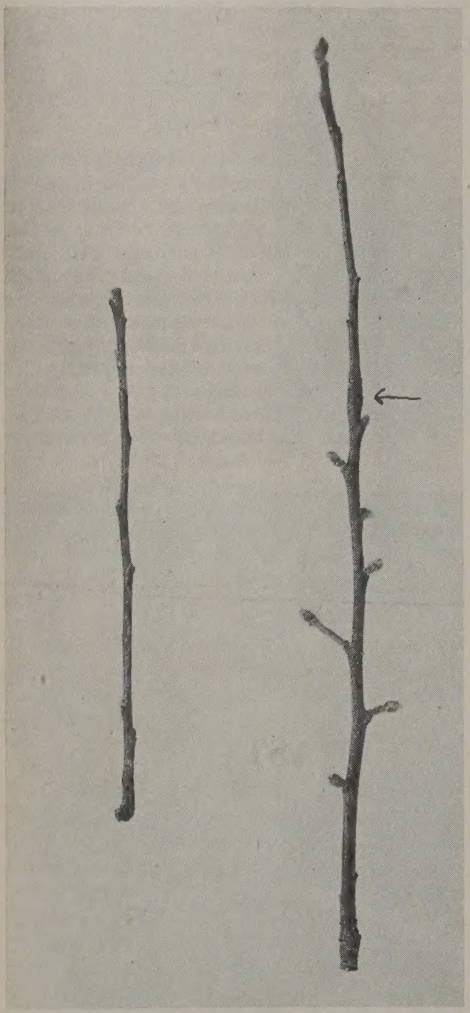

Fig. 73.—Jonathan laterals. On the left a one-year-old lateral showing side buds and terminal buds. The terminal bud is often a fruit bud and in some years a number of side buds flower and set inferior fruit.

On the right a two-year-old lateral, and a one-year-old lateral grown from the terminal bud. On the older wood, fruit spurs have developed. Pruning treatment would consist of either shortening back to the junction of the old and new wood or further back on the two-year-old lateral depending upon the amount of fruiting wood available elsewhere on the tree.

Fig. 74.—A one-year-old Jonathan lateral during the following growing season. The terminal bud has set fruit and at the same time has continued the vegetative growth of the lateral. Fruit spur formation is developing on the older wood. The result at the end of the season will be similar to the two-year-old lateral shown in Fig. 73.

The terminal fruit bud on the lateral is capable of flowering and setting fruit the following growing season; at the same time it can extend the lateral by vegetative growth as a spur, a twig, a lateral, and in some instances of severe pruning, as a wood shoot (Figs. 74 and 85).

Leaf Spur.—A short growth that can be likened to a modified lateral. It terminates in a leaf bud which, under normal conditions, can form a fruit spur the following year.

Fruit Spur.—A normal transition from the leaf spur, but it can also arise directly from a leaf bud. The bud at its apex, as the name implies, is a fruit bud. These growths are the principal fruitbearing parts of the tree. Each year after flowering, the parent spur is elongated, either singly or by two similar growths. During the course of time the spurs ramify, and

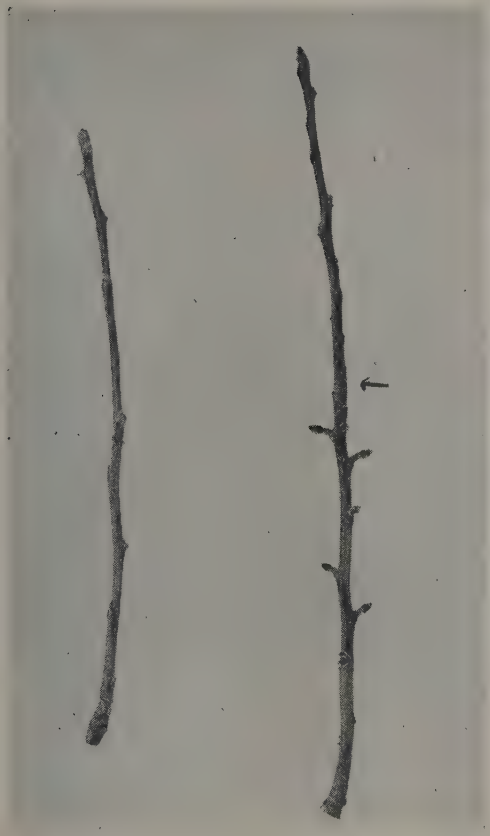

Fig. 75.—Granny Smith laterals—on the left a one-year-old lateral and on the right a two-year old lateral with a one-year-old lateral extension. When fruit spur formation is good, the lateral can be shortened back further, particularly on long laterals, than when fruit spur formation is weak. With the type of lateral illustrated, the pruning cut could be made at the junction of the one and two-year-old wood, or it could be delayed for at least another season.

ultimately become so numerous and weakened that the fruitfulness of the tree is affected, (Figs. 77, 78, 94, 95, 96 and 97).

Fruit Bud.—On the apple and pear, the fruit bud differs widely from the fruit buds found on stone fruit trees. At flowering time, the bud produces a cluster of flowers and one or two small vegetative shoots. The average number of flowers in the cluster is five, and the small shoots elongate the parent spur by similar growths. When

Fig. 76.—The fruiting habit of a two-year-old Granny Smith lateral. In addition to bearing two almost mature, apples, new growth has been made from the spur where the lateral was shortened back at the previous pruning.

stimulated by a strong sap flow after pruning laterals and even strong wood shoots can be formed instead of spurs.

Fruit and Leaf Twigs.—These are short weak growths with a terminal fruit bud or leaf bud as the case may be and usually no other buds are present.

TREATMENT OF THE ANNUAL WOOD

Hard pruning will cause most of the annual growth to consist of water shoots and wood shoots which, if the same method of pruning is continued, will have to be cut away at the next pruning. The growth will be dense and most of the laterals that are formed will be too shaded to develop properly (see Figs. 28 and 70).

Should trouble be experienced in coping with strong growth on vigorous trees, even with the more orthodox treatments, the leaders should be left untipped until some stability has been reached. Young trees, particularly in their third or fourth year, often make vigorous growth, and this growth can be utilised to better advantage by retaining the leaders untipped (see Part 2 and Fig. 29).

On any systematically-pruned tree the leaders will consist of yearly extensions, the number depending on the age of the

tree (see Figs. 72, 83, 86 and 87). Thus at the top will be the current extension; below that the extension kept at the previous pruning and so on each extension being a year older than the one above it. For the sake of convenience, the following description of pruning the annual wood will be divided into four sections. The description will commence at the top of the leader with the current extension and then cover in turn the same growth as it could be at

Fig. 77.—Granny Smith laterals. On the left is a three-year-old lateral showing three stages of development. The basal portion is three years old, the middle portion two years and the top extension, one year old. On the left on the three-year-old wood can be seen the beginning of a spur formation. When shortening back the cut would be made to a well developed spur on the two year wood, probably midway, depending on the amount of fruiting wood available elsewhere.

The lateral on the right is also three years old, but it was previously shortened back to a fruit spur. The fruit spur can, in addition to flowering and setting fruit, extend itself vegetatively by either one or two similar growths or if stimulated into growth by pruning, make stronger growth. This can be seen in the illustration; the shoot on the left a weak lateral and on the right a spur formation; both are two years old. The lateral fruited terminally and the spur bore fruit and extended itself by two similar growths. Another spur, below, similarly fruited but only extended itself once.

This type of growth would not require any pruning at this stage.

Fig. 78.—Fruiting wood on Yates. On the left a two-year-old lateral showing spur development, and three weak one-year-old laterals. The terminal bud fruited and continued growth by two small laterals. Yates respond to lateral pruning and better fruit is obtained than from spurs on the framework branches. At this pruning the lateral could be shortened back to the first spur from the top.

On the right, spur formations. Unless thinned out the spurs will ramify and fruit quality will suffer. The variety often sets heavily and requires drastic thinning, particularly when not irrigated or not on moist land. The degree of thinning out the spurs will depend on local conditions, but with the two examples shown, the formations could be reduced, leaving two well-developed spurs on each.

Fig. 79.—A five-year-old Granny Smith unpruned. At the previous pruning, long laterals were twisted together in the centre of the tree by the owner of the orchard, Mr. G. Parke, of Donnybrook. (See Figs. 83 and 84.)

Two illustrations of pruning this tree are given in Figs. 80 and 81. The first with untipped leaders and the other, the more orthodox treatment.

Fig. 80.—Five-year-old Granny Smith shown in Fig. 79 pruned, with untipped leaders. Twelve leaders have been formed in an inner and outer ring, a system adopted by some growers with success. It will be noticed that laterals on the untipped leader extensions have been left.

the end of one growing season, at the end of two growing seasons and finally, when it is some years older.

LEADER EXTENSIONS—CURRENT SEASON

The leaders are extended each year by suitable wood shoots and other wood shoots are suppressed, as was discussed in Part 2. The degree of shortening will depend upon the vigour of the tree but it should be borne in mind that one of the main reasons for shortening back is the need to force out the leaf buds other than the topmost buds, into desirable lateral growths during the following growing season. The topmost buds will normally be forced out into strong-growing wood shoots, but, if the pruning is too severe, all or most of the buds retained on the extension will grow into wood shoots (Figs. 28, 70 and 82). Conversely, if the shortening back is too light, a high proportion of the buds may remain dormant and growth will be made mostly from the topmost buds. When growth is strong it is preferable to let the leaders run rather than to shorten them lightly.

When symptoms of pruning die-back appear, or when vigour wanes, it is also advisable to leave the leader extensions unpruned. Evidence is available that growth cannot be forced into declining leader extensions by removing all spurs and laterals, rather, it seems that the retention of these growths will eventually be a means of delaying the decline, provided all fruit is removed soon after it sets. (See Figs. 92 and 93.)

Fig. 81.—Five-year-old Granny Smith pruned and with leaders shortened. The tree is not sufficiently vigorous to leave the leaders untipped; control of normal growth can be maintained by a commonsense approach at subsequent prunings.

It will be noticed that some laterals on the current extensions have been retained and the leader right foreground, has been cut to a shortened lateral to spread new growth outwards. (See Fig. 20.)

Fig. 82.—Strong wood shoots on a Dougherty graft. A number were removed before the photograph was taken in order that the framework branches could be more clearly seen.

Fig. 83.—Dougherty graft shown in Fig. 82 pruned. Strong wood shoots have been removed except those chosen as current extensions to the leaders; suitable laterals on the extensions have been retained; others being more vertical were cut to the basal rings or else well shortened back to single buds for replacement purposes. Wherever possible, long laterals have been twisted together on the same horizontal level to encourage spur formation. Weaker wood shoots in favourable positions have been shortened back to four or five buds, the cuts being made to underneath buds to minimise the possibilities of further strong growth. (See Fig. 84.)

Some laterals found on strong extensions should be retained, provided they are in a horizontal position and their terminal buds are not as high as the topmost buds on the leaders concerned (See Figs. 70, 71, 82 and 83). The treatment of laterals on untipped leaders on strong-growing trees will be much the same as the method described in the next section. (Fig. 80.)

Fruit twigs are often numerous on certain varieties, particularly Granny Smiths. When this is so, they should be thinned out to reduce hand-thinning should fruit set.

On untipped leaders, particularly Granny Smiths, the terminal bud and topmost side buds are sometimes fruit buds and fruit often sets, affecting normal growth. When this happens the fruit should be removed early. A suitable grow-

ing shoot should be selected to carry on the extension, and the tips of competing shoots pinched out to reduce competition.

LEADER EXTENSION—ONE YEAR LATER

Wood Shoots.—On pruned trees, the topmost buds on the leader extension will have grown into wood shoots, the vigour depending on the condition and age of the tree. A selection of a suitable extension, and when necessary sub-leaders, should be made as described in Part 2. and Figs. 16, 19, 25, 27, 71, 83 and 87. Other wood shoots should be suppressed, but there will be occasions when sufficient laterals are not available and it may be necessary to use weaker wood shoots for future fruit production. When this is the case, those in a more horizontal position should be shortened or spurred back to five or six buds, cutting to an underneath bud (Fig. 84).

Laterals.—The weaker and more horizontally-growing shoots — laterals — will have grown from buds, below those which have produced wood shoots, the change from one to the other being more or less transitional.

On strong-growing trees and on trees previously pruned too severely, as much of the lateral growth as possible should be retained unpruned and either tied down in an inferior position or else twisted together to reduce the possibility of strong growth during the next growing season (Figs. 71, 81, 83 and 84).

With trees more or less normally pruned, the degree of shortening back of the one-year-old lateral will depend a great deal upon its position. If it is hanging on the outer face of the leader it can be left long, but between the framework branches and inside the tree it should be shortened back according to the space available.

Some idea of spacing of the laterals can be obtained from Fig. 85. It is difficult to generalise, but normally six to eight inches should be allowed for spacing, between one

Fig. 84.—Close-up of Dougherty graft shown in Fig. 83, showing long laterals twisted together and weaker wood shoots shortened back. The leader on the left appears larger in the illustration than what it is, and this also applies to the laterals retained on the left of the leader.

shoot and another more or less directly above it. When it is necessary to thin out, preference should be given to the stronger growths, and the weaker should be removed. Care should be taken, when removing these and other growths, to cut above the growth rings at the base of the shoots as this will not remove the dormant basal buds, which may later be required for purposes of regeneration. When in doubt whether to remove or not, it would be wise to cut the lateral back to the nearest sound bud to the leader.

Laterals—Second Year.

The treatment of the laterals left on the leader extension—current season—which will now be their second year, will be discussed in the next section.

LEADER EXTENSION—TWO YEARS LATER

Wood Shoots.—On vigorous trees previously pruned too severely, strong growth will arise from the basal buds of wood shoots suppressed at the previous pruning, and also from the similar shoots cut back at the same time.

Wood shoots arising from the basal buds, if not required for framework purposes as for instance as a subsidiary leader, should

Fig. 85.—The fruiting system of a mature Granny Smith. The laterals are well distributed and the tree is capable of carrying a full crop of fruit. Intelligent shortening back, only where necessary, will minimise over-cropping and at the same time stimulate weaker wood into growth for replacement purposes. Over-stimulation by pruning should be avoided. Some of the lower laterals were shortened back too severely at the previous pruning. The result can be seen in the illustration—two wood shoots above the handerchief and a weaker shoot at the base of the leader on the left.

be removed, but if the growths are not too strong and space permits they can be shortened back to four or five buds as described in the previous section. Often too, on more balanced trees, the growth from the basal buds are laterals and if this is so, complete control has been obtained.

When wood shoots arise from similar shoots pruned short the previous year, control can often be made easier by cutting back to a lateral, spur, or dormant leaf bud on the wood left the year previously. Where possible the cut should be made to an underneath lateral, spur, or leaf bud to minimise strong growth next growing season.

Fig. 86.—The top portion of a leader on an aged Granny Smith unpruned, showing eight years' growth. In this instance the aim has been to stimulate new leader growth and to restrict fruit production near the extremities of the leaders.

Fig. 87.—Top portion leader, aged Granny Smith shown in Fig. 86 pruned. The leader extension is short and all upright growth has been cut back. The two-year-old lateral on the left has been shortened back to a spur on the two-year-old wood. In time, leader growth will weaken and it will then be essential to prune much more lightly, leaving the leader extensions untipped. Compare with Figs. 92 and 93.

Fig. 88.—The lower portion of a leader on an unpruned aged Granny Smith illustrated in Figs. 86 and 87, showing that lateral formations can be maintained on an old tree. Some new growth has been obtained for replacement purposes.

On occasions the strong growth will be difficult to handle and it is suggested that if this is so, and if room cannot be found for a sub-leader, the whole growth be removed.

Laterals—Second Year.

The laterals left at the previous pruning can now be regarded as two year laterals. During the past growing season development proceeded—in some instances fruit was carried on terminal and lateral buds, spurs were formed and growth took place from the terminal buds (see Figs. 73, 74, 75, 76 and 78).

Treatment at this pruning is important, for the reason that an important stage in fruitfulness has been reached. Many will have developed sufficient spurs to justify shortening back, otherwise too much fruit will set. Should the shortening back be too severe, strong vegetative growth may eventuate and the previous balance will be lost.

In shortening back, sufficient spurs should be retained for fruit, having in mind the capacity of the lateral to mature its crop. Knowledge can only be obtained by experience and it is suggested that in the first few years when experience is being obtained, the shortening back be done gradually and that it be no more than the junction of the old and new wood, or, in the case of long laterals, the shortening back on the older wood to include several well developed spurs (see Figs. 73, 75 and 78). When shortening back it is advisable to cut to a spur on the underneath side of the lateral to minimise the chances of strong growth next season. There will be many occasions when the extension is left entirely. Ultimately the length retained will depend on the vigour of the shoot and the quantity and quality of fruit required to be carried (Fig. 85).

The best fruit on Jonathan trees is carried on the two-year-old laterals and it is usual to make provision at each annual pruning for some new growth, much the same as is done on peach trees. Wherever possible a proportion of one-year-old laterals are cut back to sound buds to produce a supply of laterals the following year; at the same time, the remainder—if all are required—are left to mature as two-year-old laterals. The shortening back is normally to the junction of the one-year-old and two-year-old wood, but in certain years when fruit spurs are numerous the shortening back will be more severe. The degree of shortening

Fig. 89.—The lower portion of a leader on an aged Granny Smith pruned. Spur formations on the older laterals have been thinned out and spent wood removed; at the same time some one-year-old laterals have been left and those not required have been shortened to provide similar growths next year.

Fig. 90.—An unpruned leader on an aged Jonathan, still showing healthy growth.

back, as mentioned earlier, is based on experience, but it should be sufficiently severe to ensure new lateral growth (see Figs. 73, 90 and 91).

In heavy crop years, the side buds on one-year-old laterals flower and set. This is unfortunate with Jonathans for the reasons that, the previous balance between one and two-year-old wood is lost, and the quality of fruit is inferior and drastic thinning is necessary. The result the following year is usually a very light crop.

LEADER EXTENSION—LATER YEARS

Wood Shoots.—The remarks made earlier still apply—should trouble still be experienced, it is evident that the trees should be more lightly pruned.

In addition, it should be realised that wood shoots cannot be controlled by severe shortening back at each annual pruning. Where possible, they should be cut back on the older wood to a weaker shoot, or to include several shoots growing horizontally or downwards and preferably left untipped. The resulting growth can then very often be handled more satisfactorily by removing the upright and strong growth and retaining those shoots, generally untipped, which are growing in an inferior position. When good spur formation occurs, the effect of maturing the fruit, and the weight of the fruit forcing the growth downwards, will reduce the possibility of further strong growth.

Water Shoots.—With the removal of branches either by breakages or by pruning water shoots will grow from dormant buds. If the water shoot is in a favourable position it is a valuable replacement of a damaged framework branch. Otherwise it is better to remove them during the growing season, preferably by rubbing or breaking them off while the growth is young.

Fig. 91.—The upper portion of the leader on an aged Jonathan shown in Fig. 90, pruned.

The stronger terminal wood shoot has been selected as the leader extension and shortened. The lower shoot, a lateral, has been cut back to several sound leaf buds and the upright growth has been removed.

Two-year-old laterals have been shortened to well-developed spurs for fruit production during next growing season. The shortening back will also stimulate fresh lateral growth for replacement purposes. Suitably placed one-year-old laterals have been retained unpruned to mature as two-year-old laterals.

Fig. 92.—The appearance of pruning die-back on a Granny Smith leader. Pruning cuts on apple leaders should never be made to weak buds as the subsequent growth may be as illustrated. It is always preferable to leave the leader extensions untipped in such instances. (See Fig. 93.)

Fig. 93.—The leading branch of a neglected Granny Smith apple tree. It will be noticed that the leader at two previous prunings, before the tree was left unpruned, was affected with pruning die-back. Weak laterals, left untipped, have since made relatively healthy growth from their terminal buds.

Laterals.—Laterals should be shortened back when necessary, having in mind the strength and vigour of the shoot, and the position and interference of other laterals which by contact will blemish the fruit. No hard and hard fast rules can be given, but reference to Figs. 86, 87, 88 and 89 will give some indication of spacing and the degree of shortening back on older trees. There will be many opportunities to shorten back to new laterals nearer the framework branches.

It should be the aim, when pruning, to stimulate each year a certain amount of fresh lateral growth to replace worn-out or weak fruiting wood and this can be done by the judicious shortening back of the older laterals.

Spurs.—With time, spurs on the laterals and framework branches will ramify and unless they are systematically thinned-out they will become progressively weaker and cropping will become affected. Figs. 94, 95, 96 and 97). The thinning-out process is important with the variety Yates. This variety tends to set very heavily, and unless the spurs are well thinned out at each pruning, a great deal of hand thinning will be necessary.

BIENNIAL BEARING

Most varieties of apples tend to off-year and on-year bearing. This condition is difficult to overcome, but it has been noticed that, provided such an essential as cross-pollination is assured, careful pruning and early thinning will tend to even out the crops. In years when on-year crops are expected, a heavy reduction of the fruiting wood is essential. This will apply to the thinning out of spurs, a reduction in the length of bearing laterals and a shortening back of one year laterals which will often in the on-year set fruit on terminal and side buds. In the off-year the pruning should be much lighter, and, as good fruit buds will be much reduced in number, more fruiting wood than usual should be left, and the one-year laterals should be left untipped.

Fig. 94.—A portion of the framework branches of an aged Granny Smith showing ramification of spurs on laterals.

Fig. 95.—The spurs thinned out (foreground) on a portion of the framework branches of an aged Granny Smith shown in Fig. 94.

Weak growth has been removed and the treatment should stimulate some new lateral growth which will be used later on for replacement purposes.

It is realised that weather and other hazards can significantly reduce prospects, and that the expected heavy crop may not materialise. This has happened in this State several times in recent years, due to frost, attacks by thrips, and through hailstorms. However, it is suggested that the pruning of the fruiting wood be determined by the number and quality of the fruit buds; when prospects are good the reduction to be substantial, and that in the off-year every attempt be made to retain sufficient fruit buds, even if it means little or no reduction of the fruiting wood.

DISEASE CONTROL

In some districts, particularly in certain years, the disease, powdery mildew, causes damage. The disease is carried over by infected spurs, and laterals, particularly the terminal buds on one-year-old laterals. In these instances it would be wise to remove and destroy by burning all obviously infected material at each pruning.

SUMMARY

One-year-old laterals should be retained on all varieties, as it is considered that lateral pruning has many advantages over "spur" pruning.

As the spurs form, the lateral is judiciously shortened back towards the framework branches. The length eventually retained is dependent upon the vigour and position of the lateral.

It is considered wise to stimulate at each pruning a supply of one-year-old laterals to take the place of existing fruiting wood as it becomes worn out.

Spur formations should be rigorously thinned out, and they should never be allowed to become so branched and weakened that fruitfulness is impaired.

In the on-year the fruiting wood should be carefully controlled to reduce the work of hand thinning and the danger of overcropping. In the off-year the process should be reversed and little if any thinning out of the fruiting wood will be necessary.

Strong vigorous trees can best be trained with untipped leaders. It is suggested that when growth becomes less vigorous the leaders be winter pruned each year until the stage is reached when the annual extension growth shows signs of weakness; at this stage it is suggested they be again left unpruned.

(Fig. 96 (top).—A branch of an aged Dunns Seedling left unpruned for several years, showing dense ramification of the spurs.

Fig. 97 (bottom).—The spurs thinned out on the branch of the aged Dunns Seedling shown in Fig. 96. Preference has been given to the spurs with good fruit bud development.

Fig. 98.—A 14-year-old Granny Smith on the orchard of Mr. M. Hoops, of Kendenup, adapted to the Wickens system at an early age. On the left Mr. A. Gulvin, Horticultural Instructor. The previous summer was extremely dry, and as the crop was heavy, a quantity of fruit failed to make minimum size. No irrigation facilities were available. (See text—Part 2.)

The framework branches of the coloured varieties should be so spaced that ample supplies of light and air are accessible to the fruit to ensure that the characteristic colour is fully developed.

Horticultural Instructors are stationed in the commercial fruit-growing districts and are available for advice on pruning and other orchard problems. It is suggested that when in doubt as to pruning treatments, growers should contact their District Fruit Officer.

Though an attempt has been made to clarify pruning treatments, no mention has been made of the Cleopatra. This variety, owing to the prevalence of the physiological disease, "Bitter pit," is best left unpruned once the framework branches have been formed. Annual treatment usually consists of thinning out badly-placed branches and the stimulation of some new growth to take the place of the older fruiting wood as it becomes extended and weakened.

Fig. 99.—An orchard giant on Illawarra, Karragullen. The tree is a Granny Smith, 52-year-old top, worked on Dougherty, 16 years previously. The largest crop was 62 packed cases obtained during the 1949 season. On the left, Mr. J. Bloomfield, Senior Packing Instructor.

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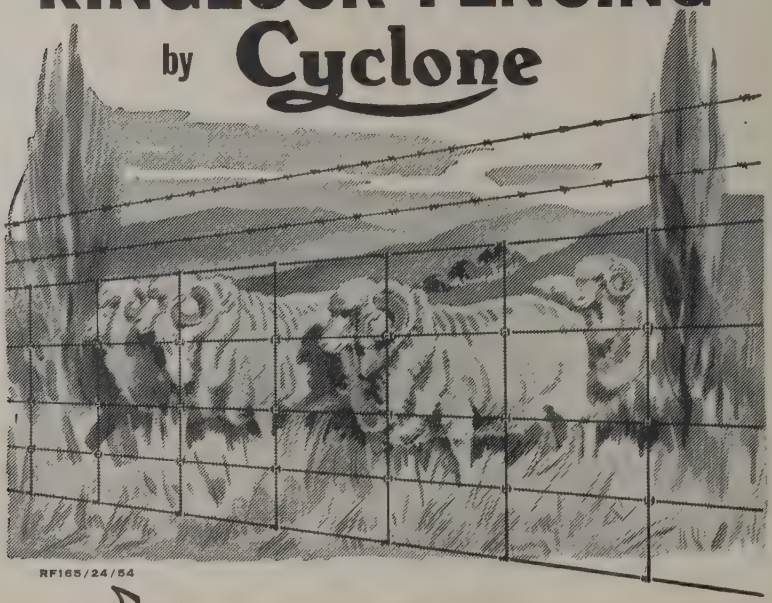

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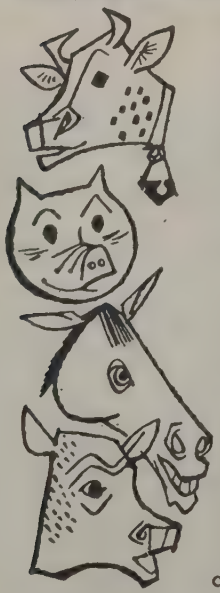

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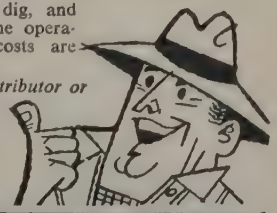

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Fig. 1.—Mr. Bateman discussed the construction of bench terraces on his Piesses Brook orchard

A ROVING FIELD DAY

Successful Innovation in the Hills Area

ONE of the most successful of a number of field days organised by the Horticultural Division during 1955 was an all-day tour of the Darling Range and Pickering Brook districts during the winter period. This "roving field day," as it was termed, proved to be a most enjoyable outing for a number of orchardists and their families and enabled the participants to inspect and discuss several interesting features of horticultural practice.

At the assembly point Mr. R. C. Owen, M.L.A., the President of the Darling Range Fruitgrowers' Association welcomed the visitors and wished them a successful day. Many growers were accompanied by their wives and families and there was quite an impressive scene as the long convoy of cars wended its way to the first stopping place, the property of Mr. E. Bateman of Piesses Brook.

Keen interest was shown in the many features on Mr. Bateman's ten-acre citrus orchard, perhaps the most spectacular of which was the series of bench terraces which had been constructed by the owner in consultation with the Soil Conservation Service of the Department. As pointed out by Mr. T. C. Miller, Assistant Superintendent of Horticulture, moisture and soil conservation were adequately provided for by this type of layout, the first of its kind in an orchard in this State. The only cultivation would be a relatively narrow strip along each terrace and subterranean clover would be used to provide a semi-permanent ground cover.

The pruning of citrus trees was discussed by Mr. R. L. Cailes, the local Horticultural Instructor, and Mr. Bateman explained his current pruning programme.

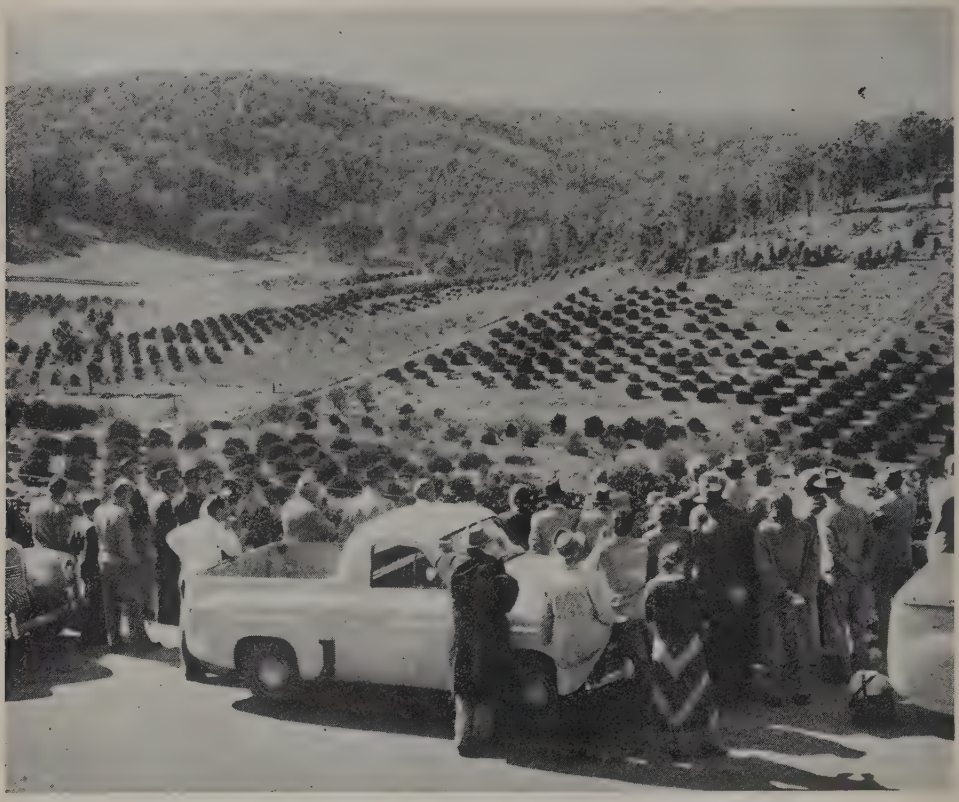


Fig. 2.—The picturesque Bickley Valley—scene of the Oriental Fruit Moth eradication campaign

The visitors were impressed with the control of white wax scale, which had been achieved by an efficient spray programme on the property. A small experimental planting of Washington Navel and Valencia orange trees raised from selected bud strains obtained from the Eastern States was also inspected.

In conclusion Mr. Bateman briefly outlined his orchard record system for keeping detailed records of tree performance. By this means uneconomical trees are pinpointed and already a start has been made to rework or replace unprofitable trees.

In the heart of the Bickley Valley a brief stop was made to enjoy the lovely panorama of mixed orchards where all types of fruits and also walnuts are being successfully grown. It was in this area that oriental fruit moth was discovered in 1951, but by a rigorous campaign as described by Mr. L. Neave the local inspector, it now seemed certain that the pest would be eradicated.

A picnic lunch at Walliston where hot water and lunching facilities were provided by the local growers organisation, provided a welcome break before continuing with the afternoon's proceedings.

The first stop after lunch was at the property of Mr. Wm. Annetts at Carmel. Here visiting growers entered freely into a discussion of peach tree pruning as demonstrated by Mr. Cailes and also listened to the comments of Mr. Annetts on his method of training the trees. An excellent orchard spray plant constructed

Fig. 3.—A grower-built spray plant created much interest on Mr. Annett's property at Carmel

by the grower from standard items of equipment was on display and provided new ideas for growers interested in building plants of their own.

The pros and cons of reworking citrus trees by budding were discussed by Mr. Cailes supplemented by the grower, who indicated the reason for changing the variety. While growers were in the citrus orchard Mr. F. Melville took the opportunity of telling them of a survey of citrus plantings recently conducted in the main citrus districts. The problem of citrus tree decline has caused concern for many years and the survey was conducted with the object of obtaining information on how widespread nematode and phytophthora root infection are in citrus orchards and their relationship to tree decline. One of the most serious aspects of the problem is the replanting of declining citrus orchards. It would appear that the most profitable lines of attack lie in resistant rootstocks and improved soil management.

The increasing importance of the Hills districts for fruitgrowing was well illustrated by the short tour of the Pickering Brook district on the way to the property of Mr. A. Niven. Extensive plantings of Granny Smith apples have been made in recent years as well as stonefruits and citrus and the production from areas such as these in the near future will be substantial.

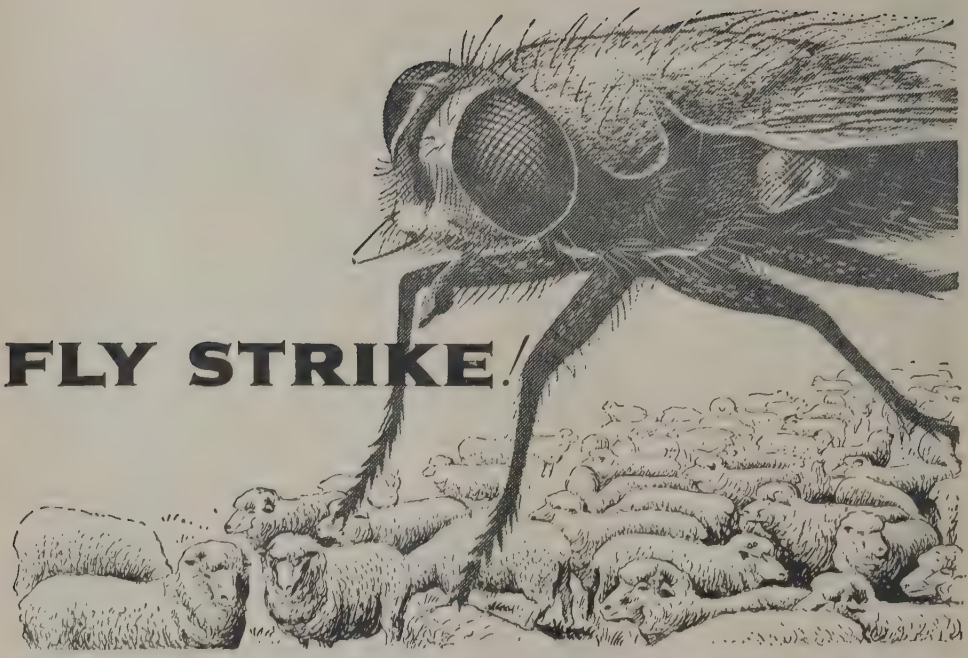
An interesting feature on Mr. Niven's property was the recently built 6,000 case cool store. It consists of four chambers each with an independent unit but so arranged that any unit may be switched to either of two adjacent rooms. The value of a store such as this to the grower and the surrounding orchardists was amply demonstrated by the fact that all chambers were filled to capacity. In a short talk on fruit storage Mr. F. Melville indicated that in the last two years seven cool stores had been built on growers properties in the hills and that a number of others were contemplated. Such facilities gave the grower much better control over the handling and marketing of his fruit and in all cases had proved very worthwhile.

A very spectacular demonstration of sprinkler irrigation was provided by the high pressure Buchner system. Each head irrigates almost two acres of orchard.

The enjoyable afternoon tea served by the ladies of the Pickering Brook-Karrragullen district at the end of the afternoon provided a pleasant conclusion to a most interesting day.

The efforts of the growers who made their orchards available and went to considerable trouble to show visitors around their properties were greatly appreciated by everyone present.

Fig. 4.—A high pressure Buchner sprinkler on Mr. A. Niven's property at Pickering Brook irrigated almost two acres at a time



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By C. F. H. JENKINS, M.A., Government Entomologist

NEW HOST RECORDS FOR THE MEDITERRANEAN FRUIT FLY IN WESTERN AUSTRALIA

THE list of fruits and vegetables from which the Mediterranean fruit fly (Ceratitis capitata Wied.) has been reared in different parts of the world is well in excess of a hundred. The susceptibility of various host plants, however, varies considerably. Some fruits such as peaches and apricots are very attractive to flies, while others such as plums and grapes are frequently left unmolested.

The factors which stimulate fruit fly attack are not fully known, but it is clear that certain fruits are consistently attractive to fruit fly and that others may be attractive only under certain conditions. It is interesting to note that three new host plants for Western Australia were recorded during the autumn of 1955.

The fruits in question were:—

Tomatoes (*Lycopersicum esculentum*)*

Olives (*Olea europea*)†

Walnuts (*Jugalans regia*)‡

The Mediterranean fruit fly has been established in Western Australia since 1895 and the most consistent infestations are to be found in the metropolitan area. Tomatoes are extensively cultivated, both commercially and otherwise in this region and olive trees are also quite widely grown. It seems reasonable to suppose, therefore, that some unusual conditions must have been responsible for these new host records after 60 years.

Several ripe olive berries in one suburban property were found infested and ten adult flies were reared in the Entomological Laboratory. In the case of the single walnut found affected, the maggots did not enter the kernel but were associated with the outer fleshy husk which in this instance was sufficiently succulent to allow two fruit fly maggots and four tomato fly

Fig. 1.—Female Mediterranean fruit fly (greatly enlarged).

* Larvae obtained 17/5/55. Flies emerged between 27/5/55 and 31/5/55.

† Larvae obtained 22/4/55. Flies emerged between 23/5/55 and 3/6/55.

‡ Larvae obtained 22/4/55. Flies emerged between 23/5/55 and 26/5/55.

maggots (*Lonchaea sp.*) to develop to maturity. The tomato has been recorded as a host of the Mediterranean fruit fly in various parts of the world, but nowhere does it seem to be a highly susceptible fruit. Referring to Hawaii, Bach & Pemberton (1918) say: "The ordinary cultivated tomato (*L. esculentum*) is not generally infested by *C. capitata.*" Bodenheimer (1915) writes: "With regard to vegetables, there is one report of tomatoes (*L. esculentum*) having been attacked 15 years ago in Palestine."

Fig. 2.—Male Mediterranean fruit fly (greatly enlarged). Note tiny club-like appendages on head.

The possibility of tomatoes being infested with fruit fly in this State has never been overlooked (Newman 1924). Numerous previous reports have been investigated, but in all such cases the maggots of the tomato fly (*Lonchaea sp.*) were implicated. One inaccurate reference to tomato infestation in Western Australia has appeared in literature (Smith 1939) but this was later corrected (Smith 1940).

The present infestation was located in a single ripe tomato purchased from a metropolitan grocer's shop, and two fruit flies and four tomato flies were reared in the laboratory. A careful inspection was made at the Wanneroo market garden where the fruit was grown but no further sign of fruit fly infestation could be found.

No definite reason can be offered for the unusual fruit fly infestations during 1955. Six hundred and fifty-five points of rain, an all time record (average 39 points) fell in February, 1955, and the conditions following these unusual downpours were very conducive to fly activity.

The record of most significance is, of course, the tomato, and a very careful watch will be kept on tomato crops next season to see if any further sign of fruit fly attack can be detected. From previous experience, however, not only in this State but in other parts of the world, it seems reasonable to anticipate that the recent infestation will prove to be an unusual and isolated occurrence and not an indication that tomatoes will assume an important role as fruit fly hosts in this State.

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FARMERS

This is YOUR Journal, and it has been written, edited and presented in a sincere endeavour to give you helpful information in an interesting manner.

We would like to have your views on the Journal—to know whether you like it or whether you don't. Drop a line to the editor and tell him the features you like and don't like in this issue—or the features you hope to see in future issues.

PEDIGREE SEED

Wheat, Oats and Barley

THE Minister for Agriculture, Hon. E. K. Hoar, M.L.A., has advised that supplies of pedigree seed wheat, oats and barley will be available for distribution from the forthcoming harvest at the Department's Research Stations.

Varieties available this season are:—

WHEAT

Mid Season.

Baroota Wonder (Hay variety).
Bencubbin.
Bencubbin 48 (Rust resistant).
Eureka (Rust resistant).
Kondut.

Early.

Gabo (Rust resistant).
Wongoondy (Rust resistant).
Insignia 49 (Rust resistant).

Very Early.

Bungulla.

OATS

Late.

Algerian.

Mid Season.

Avon.
Dale.

Early.

Ballidu.
W 30.

Very Early.

Wongan.

BARLEY

Early.

Atlas (6 Row).
Beecher (6 Row).
Prior (2 Row).

Early Mid Season.

Maltworthy (2 Row).

Prices per bag of three bushels, inclusive of rail freight to farmers Siding will be:—Wheat 60s.; Barley 55s., and Oats 40s.

Short descriptions of the wheat, oats and barley varieties which are being distributed for the first time this season are given hereunder.

WHEAT

Insignia 49.

Early maturing, with short strong straw. Holds grain well. Suitable for the medium and low rainfall areas. Moderately susceptible to flag smut. Resistant to rust. Slightly superior to Bungulla in flour quality.

OATS

W 30.

A crossbred selected from the cross Ballidu x M 59, made at the Wongan Hills Research Station. Early maturing and similar to Ballidu in height and straw strength. Has ability to give high yields of grain. Satisfactory for grazing and recovery for grain.

BARLEY

Beecher.

An early maturing 6-row type. In grain yield it is similar to Atlas but does not recover from heavy grazing quite as well. Possesses semi-smooth awns which is an advantage when feeding to stock.

Supplies of these new varieties will be very limited and definitely not more than one bag per applicant.

Prompt attention to orders will be ensured if the following directions are observed by intending applicants.

(1) Make early application direct to Department of Agriculture, St. George's Terrace, Perth.

(2) Give clearly, full name, postal address, and Siding to which the seed is to be railed.

(3) As soon as possible after receipt of account remittance should be forwarded. Statements are sent out in the order of receipt of the application. No definite reservations can be made until the seed is paid for.

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Rules of the Western Australian Official Pure Bred Dairy Cattle Production Recording Scheme

CONDUCTED BY THE DAIRY BRANCH, DEPARTMENT OF AGRICULTURE
WESTERN AUSTRALIA

THE rules of the West Australian Pure Bred Dairy Cattle Production Recording Scheme have been revised and are published for the benefit of interested farmers. The two important alterations are the increase in length of lactation from 273 to 300 days and the raising of the butterfat standards of the younger age groups. Owners of all Pure Bred Herds which are under test have already been notified of these alterations which became effective from May 1 this year. A number of minor alterations have also been made but these do not materially affect the testing procedure or calculation of results.

(1) Title.

The scheme shall be known as the West Australian Official Pure Bred Dairy Cattle Production Recording Scheme.

The official year will commence on May 1 and end on April 30.

A farmer desirous of having his herd tested shall at the commencement of the testing year submit an application form for the testing of his herd. Such application should be on the form attached Schedule A and be accompanied by the prescribed fees. An owner wishing to have cows exempted from the payment of fees for cows classified as "B" class should also complete the form of application as in Schedule B.

(2) Eligible Cows.

Only those cows will be accepted to the Official Scheme which are registered or have been accepted for registration in a recognised Herd Book or "Pure Stock" register.

(3) Identification.

Any cow entered for test, or any calf, the progeny of such cow must be indentified to the satisfaction of the Department of Agriculture.

(4) Classification.

All cows in the herd shall be tested annually. Such cows will be classified, on receipt of entry forms, or at the commencement of the first test as follows:—

(a) "A" Class cows.

(b) "B" Class cows.

The records of yields of "B" class cows will not be published or used in calculating average either for the herd or the scheme as a whole.

The following cows may, with the approval of the Superintendent of Dairying, be classified as "B" class:—

(i) *Cows which have aborted.*

(ii) *Sick cows.*

(iii) *Cows with permanently diseased udders* or which milk from less than four quarters.

(Cows in category (ii) and (iii) automatically become "A" class if they produce 200 lb. butterfat in the first six months of their lactation period.)

(iv) *Strippers.*

A stripper is defined as:—

(a) In herds entering test for the first time, a cow which has calved more than 150 days prior to the first test.

(b) in herds continuing in test, a cow which has already completed a full lactation period in the preceding year and has not again freshened.

(v) *Nominated cows.*

(A nominated cow is one which has calved normally but which on entry to test is nominated for culling. If such cows are not disposed of by six months after calving, they will automatically become "A" class.)

(vi) *Cows over 12 years of age at date of calving which have been tested for four lactation periods.*

(vii) *Heifers which have calved under the age of one year, six months.*

(5) Fees.

Each owner shall pay to the Department of Agriculture on entry of his herd and annually thereafter at the commencement of each recording year, a herd entry fee of six pounds (£6). There shall also be paid in advance an amount of ten shillings (10s.) testing fee for each lactation of all "A" class cows submitted for test.

(6) Dual Herds.

Where a breeder owns more than one herd or desires the Recording to be done at more than one centre, each shall be considered a separate herd and a separate entry fee will be required.

(7) Lactation Period.

For the purpose of calculations, the lactation period shall be 300 days, which shall be divided into ten (10) sub periods of 30 days each. Cows may be continued under test for 365 days at the owner's request and the lactation shall consist of 11 periods of 30 days and a twelfth period of 35 days.

(8) Method of Calculating Records.

The yields for the Official Record shall be calculated as follows:—

The cows shall be tested once in each sub period at approximately equal intervals of time.

In the event of it not being possible to make a test immediately after an interval of 30 days, the test may be taken not more than 35 days nor less than 25 days after the preceding test, and if this is not practicable, the calculations for the sub period concerned shall be obtained by averaging as in the case of an abnormal test. (*vide* rule 19.)

The official yield shall be the sum of the yield of each sub period.

The yield for each sub period shall be calculated as follows: —

The milk yield shall be the amount produced over a period of 24 hours multiplied by the number of days in the sub period.

The butterfat yield shall be determined by multiplying the number of days in the sub period by the sum of the individual totals obtained from separate tests of each milking during the 24 hours.

(9) Who Shall Test.

The testing shall be done by qualified officers appointed by the Department of Agriculture.

(10) Location of Testing.

Testing for butterfat of samples of milk taken during Recording, may be carried out by the Recorder on the farm or may be taken under adequate protection to be tested at an approved centre.

(11) Commencement of Test.

No cow shall be tested unless 5 days (120 hours) have elapsed since calving.

(12) Weighing, Sampling and Testing of Milk.

Each test shall be over a period of 24 hours and the milk shall be weighed and samples tested for butterfat separately night and morning.

(13) Stripping out Cows Under Supervision.

The Department retains the right to supervise the stripping out of all cows at the milking immediately prior to the commencement of the official 24 hour period.

(14) Recording Milk Weights.

The milk shall be weighed on approved scales and the weights recorded on a printed sheet supplied for the purpose.

Particulars as to the date of calving and services shall be supplied to the Recorder on request.

(15) Rations Fed to Cows.

Owners must give the recorder information as to the class, quantity or any other details regarding the ration fed during the period of the test, and allow samples of the various food stuffs to be taken for analyses, when deemed advisable by the Department.

(16) Production of Milk Over 50 lb. Per Day.

When the yield during the 24 hours exceeds 50 lb. of milk the cow may be milked three time per day, provided that it is the owner's general practice for the purpose of relieving cows. Where such cows are milked three times per day it shall be stated clearly in the records.

(17) Prohibited Feeding.

The feeding of whole milk or cream to cows undergoing test is prohibited.

(18) First Test Taken More Than 44 Days After Calving.

In cases where owners are commencing to test their herds for the first time, or where it has been found impracticable to test certain cows until after they have been calved for a period of more than 44 days and on receipt of a statutory declaration from the owner as to the date of calving the cows may be credited with milk and butterfat production as shown hereunder, such credit to be based on the first 24 hour test made by the Official Tester.

No. of days elapsing between calving and first test.	Period of production credited on first test days.	No. of tests required for 300-day lactation period.	Method of arriving at the 10th sub-period.
5–44	30	10	Treat 10th test as for normal sub-period.
45–74	60	9	Treat 9th test as for 10th sub-period.
75–150	90	8	Treat 8th test as 10th sub-period.

(19) Averaging Abnormal Tests.

When a yield of butterfat during the 24 hour test period differs by more than 25 per cent. from the preceding test, such test may be treated as abnormal. Reasons for abnormality shall be noted by the Official Recorder. In the case of a cow testing abnormally, such test shall be recorded, but may not be used in calculating the yield for the lactation. In such case an average will be made from the proximate and succeeding tests to determine production for the sub period.

(20) Issue of Certificates.

The Department of Agriculture shall issue a certificate showing the records of each cow which attains or exceeds the required standard.

A junior 2 year old shall be one which is under 2½ years of age on day of calving.

A senior 2 year old shall be one which is 2½ years but under 3 years of age on day of calving.

A junior 3 year old shall be one which is 3 years but under 3½ years of age on day of calving.

A senior 3 year old shall be one which is 3½ years but under 4 years of age on day of calving.

A junior 4 year old shall be one which is 4 years but under 4½ years of age on day of calving.

A senior 4 year old shall be one which is 4½ years but under 5 years of age on day of calving.

A mature cow shall be one which is 5 years of age or over on day of calving.

(21) Standards of Production.

The standards upon which certificates shall be issued are shown hereunder:—

Junior 2 year old—260 lb. butterfat.
Senior 2 year old—280 lb. butterfat.
Junior 3 year old—300 lb. butterfat.
Senior 3 year old—320 lb. butterfat.
Junior 4 year old—330 lb. butterfat.
Senior 4 year old—340 lb. butterfat.
Mature cows—350 lb. butterfat.

(22) Milk and Butterfat.

All calculations made in computing the test shall be recorded only in pounds of milk and pounds of butterfat.

(23) Publishing Records.

All records may be published by the Department of Agriculture, as it deems advisable.

(24) Sworn Declarations.

All particulars given to the Recorder shall be on a sworn declaration when deemed necessary.

(25) Facilities.

Satisfactory facilities to enable the Official Tester to carry out his duties must be provided. These should include:—

(a) A bench in the milking shed or milk room for use whilst taking samples and recording details for cows and their yields.

(b) A firm bench to carry the centrifuge during testing.

(c) Adequate supplies of hot water for testing and cleansing equipment.

(d) Adequate ventilation and lighting.

(26) Responsibility for Transport and Accommodation.

The owner shall arrange transport of the Recorder and his equipment to and from the nearest public transport to the place of testing.

Accommodation must be provided over night if required and meals supplied whilst the tester is on duty on the property.

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Changes in Pastoral Vegetation can Provide a Guide to Management

By H. SUIJDENDORP, B.Sc. (Agric.), Agricultural Adviser, North-West Branch

Fig. 1.—Woollybutt grass (*Eragrostis eriopoda*) has almost disappeared from this plant community owing to continuous grazing. Note the dead butts in between the clumps of soft spinifex (*Trioda pungens*), which is rapidly taking over the area

OVER approximately half the area of Western Australia, stock are being grazed on the native vegetation—plants which, over the years, had adapted themselves to the soils and climatic conditions and which were growing in profusion when the white man first took his flocks and herds into the areas.

Such plants had probably been growing there for centuries, and the pastoralist was inclined to assume that they would continue to flourish.

Admittedly, the country was now called upon to carry a greater number of livestock, but it appeared to be producing more than enough vegetation to satisfy their requirements. Even after years of fairly heavy stocking, most of it still carried plant populations that seemed to be more than adequate for the needs of the animals.

Despite this apparent wealth of pasture, however, the carrying capacity of many areas was declining rapidly, and it was found that this was caused by the progressive eating-out of the more palatable and more nutritious species and a consequent increase in the less desirable plants in those areas.

In other words, although the **quantity** of pasture often remained more or less unchanged, the **quality** had deteriorated to an alarming extent.

DEFERRED GRAZING.

To reverse this trend—in other words, to improve the quality of the vegetation—the practice which we have called "deferred grazing" has been advocated.

"Deferred grazing" has been tested under field conditions and undoubtedly gives results.

Fig. 2.—After burning the area shown in Fig. 1, seedlings of many species sprang up but were grazed off until only the soft spinifex remains. Deferred grazing would have prevented spinifex dominance

Briefly it consists of excluding stock from a portion of the run after the first rains, so that the plants can grow unchecked, and in due course mature and set seed. Under the normal conditions in our pastoral areas, this is only for a brief period—say about six weeks.

Once the seed has matured and commenced to drop, the stock are brought back into the area, preferably at a heavy stocking rate, so that the seed is trampled into the ground instead of being blown away or taken by birds and insects.

Fig. 3.—Tarbush or wild mustard is an annual which often appears after a burn. On well-managed country, the annuals usually give place to perennials in a few years. Where the annuals persist, the chances are that the quality of the pasture is still declining

A SOUND POLICY

Deferred grazing is a sound policy that has been tried and tested by practical station men.

It is obvious that where stock are allowed to graze at will, they will concentrate upon the tastiest—and these are usually the most nutritious—plants. They will eat them back to such an extent that, not only will the plants fail to set seed, but they will have little or no opportunity to accumulate root reserves to tide them over the dry period.

Consequently many of these desirable species will die off and their places will be taken by other plants not relished by stock.

This is what has actually been happening for years in our North-West—and that is why the carrying capacity of many runs has shown an alarming decline. Many valuable native plants and grasses have gone from the plant population to be replaced by spinifex.

The nutritional value of spinifex is low. The better types will keep dry sheep alive, but something better is needed for pregnant ewes or to provide a milk-producing ration for ewes with lambs.

Deferred grazing allows the desirable plants to increase by setting seed, and permits the mature perennial plants to store up the necessary nutrients to carry them over the dry period.

Even after one application of the deferred grazing technique, it has been found that there was a marked increase in the proportion of the better types of pasture plants.

Fig. 4.—Cockroach bush, or emu bush as it is sometimes called, is an unpalatable plant which often appears after a burn but usually disappears within a few years. Persistence of this plant also indicates a downward trend in the quality of the vegetation

If a second spell of deferred grazing takes place during the next wet season, a still greater improvement in pasture quality takes place.

The ideal technique is to practice deferred grazing on a third of the run for two successive seasons, so that the whole area is given two treatments every six years.

PASTURE CHANGES SHOULD BE CLOSELY STUDIED

During the deterioration or improvement of a pastoral area, the changes in the composition of the plant communities afford a valuable guide to management.

If these changes are carefully studied as they occur, it will be possible to apply deferred grazing in the areas where it will be most useful.

Grazing trials at Woodstock Station showed that the condition of the stock is a very unsatisfactory indication of changes in the quality of the pasture.

While they are wrecking the vegetation, the stock are apt to remain in good condition as they keep the grasses eaten down during the growing season and are subsisting on young, highly nutritious shoots coming up over an extended period.

As was explained earlier, the plants under continuous grazing are prevented from setting seed or establishing root reserves, so that serious damage is done to

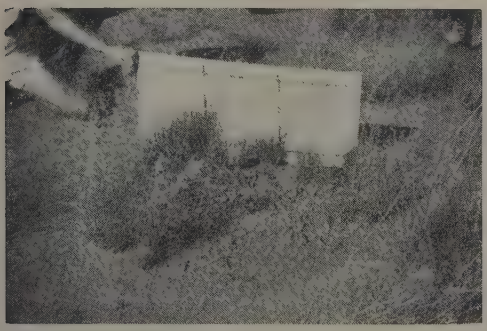


Fig. 5.—Woollybutt grass *(Eragrostis eriapoda)* is being allowed to seed by deferred grazing technique. When the seed commences to fall, the area will be heavily stocked to ensure that seed will be trampled into the ground and not blown away or removed by ants and birds

Fig. 6.—A good stand of grass seedlings after one season of deferred grazing. Stocking was at the rate of a sheep to three acres. Tops of mature plants may be seen in the right foreground

the pasture before the animals start to lose condition at the end of the growing season.

Under controlled grazing conditions on experimental plots at Woodstock Station, the sheep did not achieve such a high level of bodyweight as those on continuous grazing, but they maintained their condition throughout the year.

Furthermore, the quality of the vegetation was improving all the time.

Remember, that the practice of leaving stock in a paddock for as long as they continue to do well will have disastrous consequences for the plant community.

The photographs accompanying this article, illustrate some of the changes in vegetation which indicate good and bad pasture management.

In Fig. 1 it will be seen how "woollybutt grass" *(Eragrostis eriapoda)* a useful perennial, is disappearing from the plant community owing to continuous grazing. Only the dead butts remain. The less palatable and less nutritious soft spinifex *(Triodia pungens)* once covered about 50 per cent. of the area but is now taking over space once occupied by woollybutt grass.

Unless the woollybutt grass can be encouraged to persist, by deferred grazing the entire area will soon be occupied by spinifex only. The nutritional value of this spinifex is too low to support pregnant or lactating ewes.

If the vegetation in Fig. 1 is burnt and stocked after the seedlings have appeared, the only surviving seedlings (Fig. 2) will

Fig. 7.—Perennial weeping grass *(Chrysopogon latifolius)*, the most palatable of the local species

be those of the unpalatable species (in this case, soft spinifex). Deferred grazing would have given other plants a chance to become established and prevented spinifex dominance at such an early stage.

After the burning of spinifex country a number of plant species will usually germinate. Many are annuals which have their place in the normal succession after a burn. Tarbush or wild mustard, shown in Fig. 3 is one of these annuals.

If the country is managed correctly, the annuals will be replaced by the more useful perennial species within a few years.

If the annuals are still prominent after two or three fair seasons, the chances are that the vegetation is on the downward trend. This can be the result of too high a stocking rate or consistent stocking during the growing season. Even a low rate of stocking at this time can ruin good country.

Although tarbush is regarded as good feed, its persistence over the years is a bad sign.

Fig. 8.—This is the same country as shown in Fig. 1 after receiving deferred grazing treatment for two seasons. It also carried a sheep to three acres but now contains a 50-50 mixture of perennial grasses and spinifex. In this condition it could carry breeding stock successfully.

Fig. 9.—Buffel grass has commenced to establish itself in the plough-furrows on this wind-eroded claypan

Another plant which, if persistent, indicates a downward trend, is cockroach bush or emu bush (*Cassia notabilis*) (Fig. 4). It often emerges after a burn, but usually disappears after a few years.

In Fig. 5 we see woollybutt grass (*Eragrostis eriapoda*) being allowed to go to seed, and Fig. 6 shows a good stand of grass seedlings emerging after one season of deferred grazing.

Fig. 7 shows perennial weeping grass (*Chrysopogon latifolius*) the most palatable of the local species. This grass reestablished itself in one of the deferred grazing plots at Woodstock, although it had not been noticed in that area for some years. Being most palatable it is usually the first grass to disappear and the last to return.

At this stage however I would remind readers that we still know very little concerning the response of different plants—and this grass in particular—to the variable seasons experienced in this area. This climatic factor, superimposed on the grazing factor, may hide or accentuate the vegetation changes.

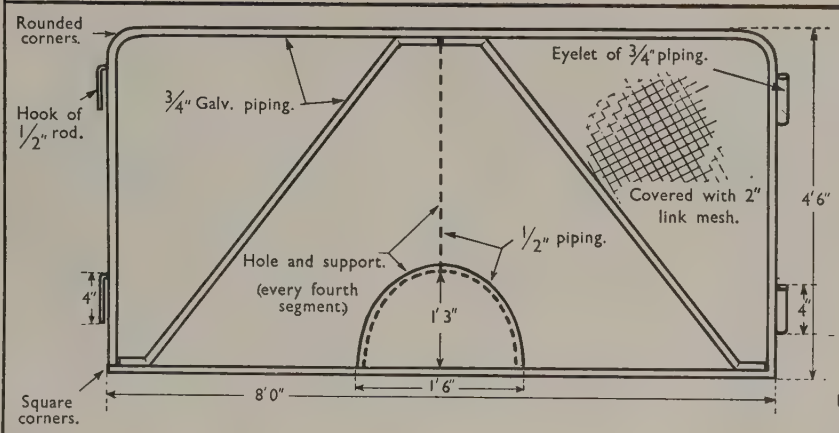
To illustrate the marked change brought about by two successive seasons of deferred grazing on the country shown in Fig. 1, I have included Fig. 8. This photograph shows a very healthy stand comprising perennial grasses and spinifex in approximately equal proportions. This was stocked at the rate of a sheep to three acres, and the vegetation would now be sufficiently high in quality to support breeding stock.

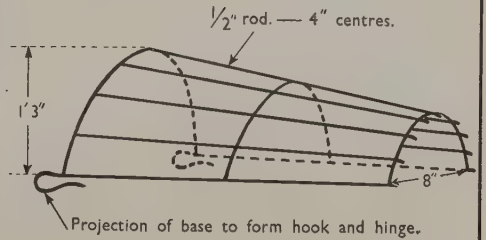
So far, this discussion has centred upon the mixed spinifex—perennial grass country. On the better grassplains, the result of overstocking is far more dramatic. In this case, the whole of the plant cover can be eaten out and as there are unpalatable species to take over, the ground is left bare.

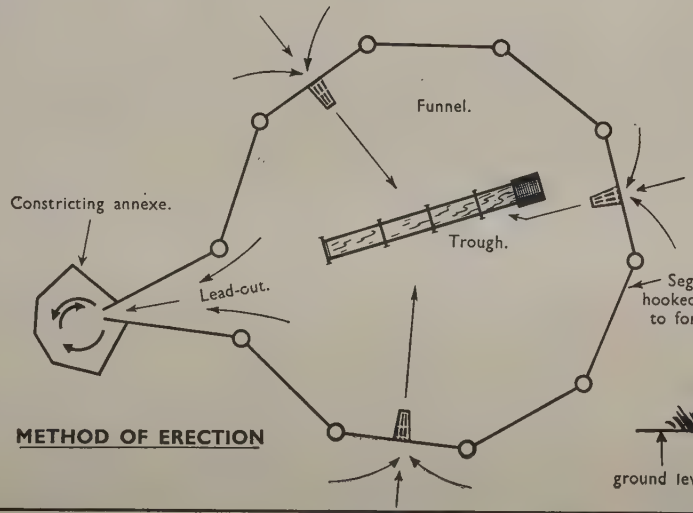
Wind erosion on these bare areas, can remove several feet of topsoil, leaving vast "claypans."

Contour or "checkerboard" cultivation, followed by controlled stocking has been used to reclaim these areas. The photograph (Fig. 9) shows buffel grass (*Cenchrus ciliaris*) becoming established on the furrows.

PORTABLE WALLABY TRAPPING SEGMENTS







METHOD OF ERECTION

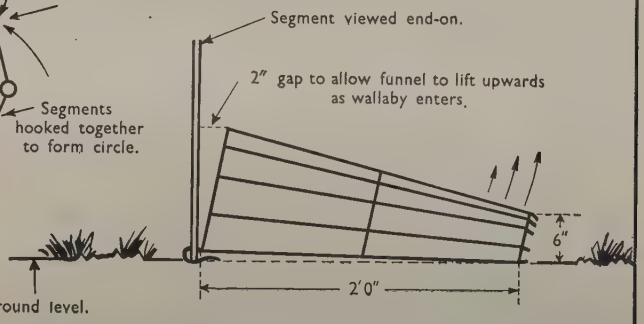


Fig. 1.—Erecting the original trapping yard at a dam on Quanbun Station

TRAPPING YARDS FOR KANGAROOS

By C. D. GOODING, Vermin Control Research Officer and L. A. HARRISON, Vermin Research Technician

MARKED increases in the kangaroo and wallaby populations over large sections of Western Australia's pastoral areas have produced many inquiries for some type of trapping yard which would give good results if erected at wells and other water supplies.

It is not claimed that the traps described in this article are new in principle as they are merely a modification of the old type of water trap which has been used for catching rabbits probably ever since that pestilential rodent appeared in plague form.

The traps which are pictured and described here were primarily designed for the capture of sandy wallabies, in the Kimberleys, for purposes of research. These wallabies only reach a stature of between 2 and 3ft., and weigh on the average about 20 to 25 lb. If the same type of trap is to be used for the larger kangaroo species such as the euro (biggada) or marloo (red kangaroo), then appropriate alterations will have to be made in the specifications. The sizes given proved entirely satisfactory for the sandy wallaby which constitutes a serious problem in the Kimberleys.

The essentials for successful trapping are:—

(1) Thirsty animals (this means that traps are most effective during hot weather).

(2) A supply of water which can be easily fenced off.

(3) A strong enclosure.

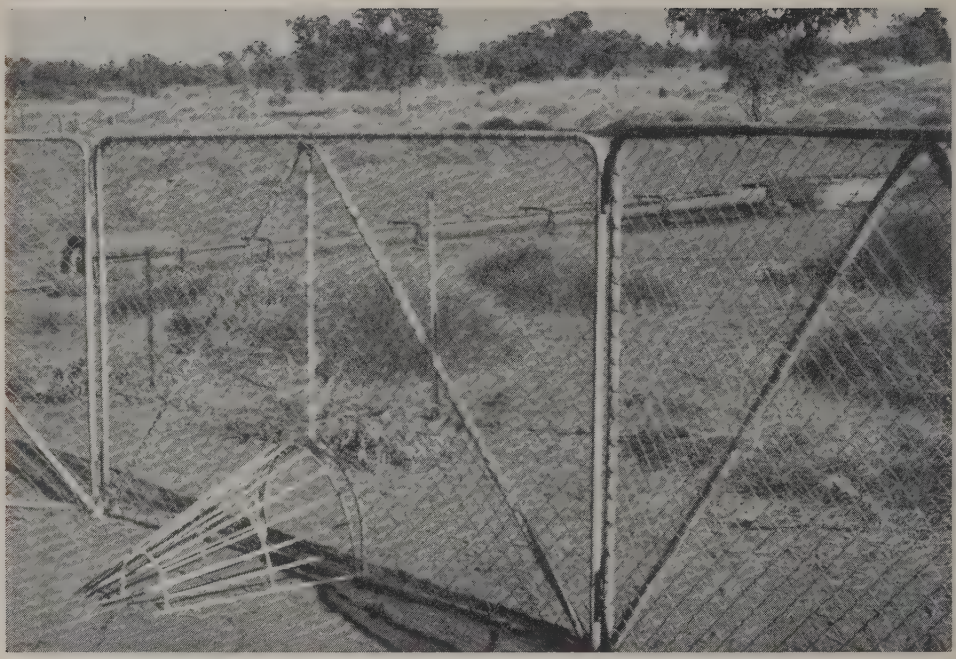


Fig. 2.—Some of the portable segments in position at Liveringa Station, West Kimberley

(4) Funnels leading into this enclosure which permit of fairly easy entry but which prevent exit from the yard.

The enclosure when erected around the water must be left open to stock during the day time and then closed off again at night-fall. The presence of other water supplies at the trapping site will prevent successful trapping, and these must either be drained or covered each evening and opened again next morning.

DESCRIPTION

The possibilities of this type of trapping were first recognised when a temporary structure was erected at Quanbun Station, in the Derby hinterland, to obtain animals for experimental purposes. This was a makeshift structure made from steel standards, a roll of link mesh and two improvised funnels. This trap served its purpose and showed how the design could be further improved.

Later, a set of portable frames were made. These consisted of gate-like segments made from ¾in. piping and covered with 2in. link mesh. The segments were fitted with hooks or hinges which fitted into "eyes," which consisted of short lengths of ¾in. piping, welded to the ends of the frames to permit rapid assembly and dismantling. Some of the segments had semi-circular openings cut in the centre of the lower portions, and these holes were framed with ½in. piping. Funnels made from ½in. mild steel rod were fitted on the inner side of the hole (see specifications).

The great advantage of the improved type of enclosure is the readily portable nature of the component parts and the ease of erection at a new site. From the economic angle, this is of utmost importance as labour costs play an important part in the economics of pest control.

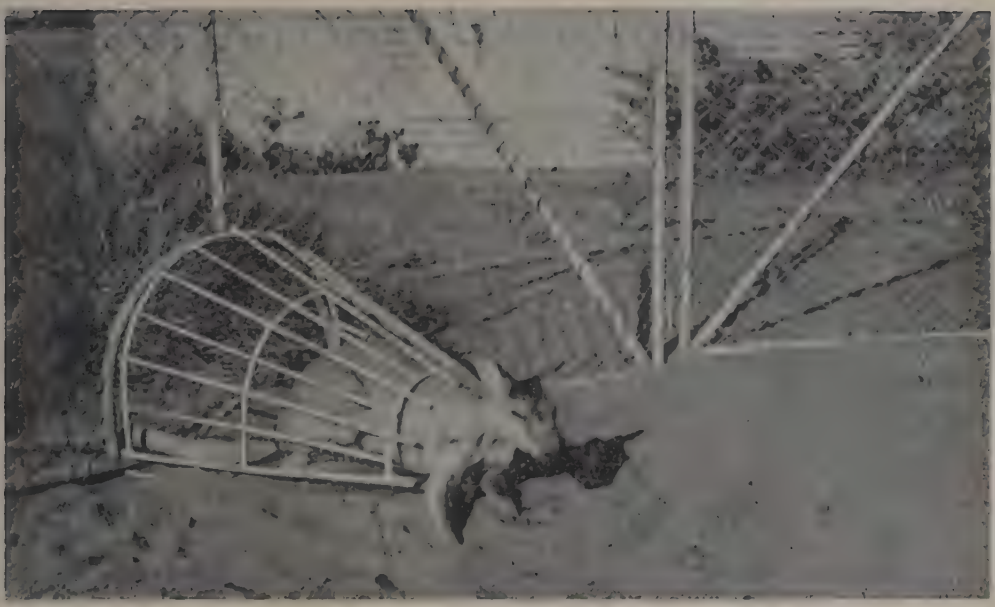


Fig. 3—A wallaby entering through the funnel. Note how the inside end of the funnel has been raised from the ground. This photograph was taken at Montgomeries Bore, Liveringa Station

Another refinement which was added to the portable yard was the provision of a lead-out funnel, made from the frames, which permitted the wallabies to move out of the main yard into a small crush pen. Once in this small enclosure, the wallabies cannot jump around nor injure themselves and can be destroyed without difficulty.

Fig. 4.—Part of one night's catch at Grant Range Bore, Liveringa Station

PRACTICAL OBSERVATIONS

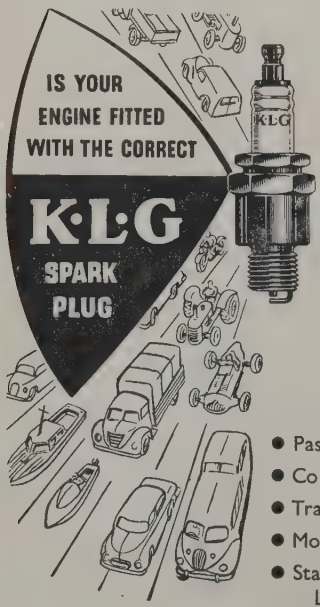
It will be realised that a fairly large expenditure of labour will be involved in opening up and closing of water supplies and this work is an important factor in successful trapping.

The time required to successfully eradicate the kangaroos visiting a mill, and the expense of equipping each mill with a water trap would be much greater than would be required to obtain similar results by water poisoning. Some indication of the time it takes to clean up a mill may be gained from these figures of catches obtained at Quanbun Station on successive days. On the first day 35 wallabies were caught and these were followed by catches of 30, 22, 2, 23, 19, 16 and 10, making a total of 157 spread over eight days. The fourth day's catch of only 2 animals was due to the presence of an exposed pool of water left under an adjacent trough. This was located and fully utilised by the wallabies.

It will be seen that at the end of eight days we were still catching about one-third of our initial take. Many of these were probably wallabies which habitually moved from mill to mill but possibly some would be animals which had been deterred from entering the funnels on previous nights and had moved to other mills and later returned to the original mill trough. This would suggest the necessity of trapping large numbers of mills simultaneously so as to pick up these wanderers.

It has been suggested that control by means of water traps would have special attraction for kangaroo shooters hunting for skins, as they would be assured of good catches at each mill.

In this connection however it should be remembered that the best trapping period would be during the summer months when skin prices are usually at a low level.



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STURT PEAS FOR YOUR GARDEN

By F. BRIDGMAN, B.Sc. (Agric.)

DURING recent years, many home gardeners have shown increasing interest in our unique and highly attractive native plants. This is understandable, for many of our indigenous plants such as the Sturt pea, Leschenaultia and kangaroo paw have a beauty of form and colouration which compares more than favourably with many richly prized importations. Contrary to popular belief, cultivation can, and does improve the flowering qualities of many native plants.

Among the native plants that can be cultivated without any great trouble—note the words "without any great trouble"—there is the Sturt pea. In my own garden in the outer metropolitan area on sandy loam to clay loam soils, I have personally grown Sturt peas for over eight years—without failing to secure some flowering plants each season. As a guide to those people who would like to try this striking flower in their gardens, the following notes on its cultivation are given.

The Sturt desert pea which is botanically called *Clianthus formosus* and which has also been called *C. Dampierii,* is found growing naturally over wide areas of the semi-arid and arid interior of Australia. While there is considerable variation in the habit of the plants from prostrate to erect, characteristically the Sturt pea has long stems which lie on the surface of the ground—a somewhat similar habit to melons and cucumbers though this is only a rough comparison. Sturt pea stems in garden conditions can cover six feet of ground or more. When planted thickly, however, Sturt peas make considerable upward growth to two or three feet in height. Plants can be trained to grow up a trellis or other support, but tying is required. Under natural conditions, Sturt peas are possibly perennials (their life span is actually doubtful) but in any case, under cultivation in the wetter areas, they are best treated as annuals.

VARIETIES AND AVAILABILITY OF SEED

Besides the flaming scarlet flowers with the commonly known shining black centres, various gradations to a light red with claret centres also occur fairly frequently. These kinds can often be found in ordinary commercial seed that may be purchased in small packets from most seed merchants. Rarer variations of Sturt peas occur in the interior regions, including a pinkish-white and a pink and white mottled kind. Even white flowers occur, but seeds of these cannot be obtained readily, nor indeed is it known for certain whether these types are really hereditary "sports" or the effect of some environmental influence.

SUITABLE DISTRICTS AND SOILS

Districts suitable for the garden cultivation of Sturt peas include the metropolitan area, most of the South-West and the wheatbelt as well as the Goldfields and interior. Most soils can be used including sandy loams to clay loams, even poor Perth sands. The soil should be deep with no obstructions to the penetration of the long tap-roots. The land should be well drained and the situation sunny.

TIME OF PLANTING

In the dry interior where Sturt peas are native they can grow over the cool season and flower in spring, but wet conditions combined with cold are readily fatal, and they are also susceptible to severe frosts. Consequently, for garden cultivation where winters are relatively severe—as in the metropolitan area, the South-West and parts of the wheatbelt, Sturt peas are best treated as summer annuals like zinnias or asters. The sowing time in most of these areas should be spring to summer —starting when the soil is warm enough for germinating zinnias, for instance, which will vary from September to late November according to the locality. Sowing can be continued until as late as February. I have found January quite a good month for sowing for autumn flowers. In areas near Perth, Sturt peas can continue flowering until June, after which weather conditions usually spell finis to the plants.

Where winters are mild and fairly dry as in the Geraldton area, Sturt peas would be worth while trying with autumn sowing to flower in spring, but I have had no personal experience under these conditions.

SOIL PREPARATION AND FERTILISERS

The soil should be dug in the usual manner, no special methods being needed.

There is some misapprehension about the use of artificial fertiliser on native plants. However, Sturt peas like some other native plants definitely appreciate and respond to superphosphate. A maximum of up to 2 oz. per square yard of superphosphate can be used, but usually about 1 oz. per square yard will be sufficient, especially where fertilisers have been used previously for other plants. Part of this superphosphate should be worked into the surface—it may even be sprinkled quite near, but not in contact with the seeds—while part should also be worked into the full depth of the soil dug.

On poor sandy soils, potash can be beneficial—up to ½ oz. per square yard of muriate or sulphate of potash being applied so as to avoid direct contact with the seed. Animal manures and compost are not necessary. Trace elements should not be required in ordinary circumstances—only where a proven deficiency of any such factor is known to exist, and such a deficiency has not been remedied by previous garden manuring, should they be considered. Regarding lime, the position is not very clear, but I have grown Sturt peas without lime on soils with a fairly acid pH of 5.2. Generally lime does not appear necessary.

NITROGEN-FIXING BACTERIA

Sturt peas belong to the legume family, like peas, clover and beans, and as such they can carry nitrogen-fixing bacteria in nodules on their roots. But unlike the nitrogen-fixing bacteria of clover, very little is known about Sturt peas in this regard, and no bacterial cultures specifically suited to Sturt peas are available. One method is to rely on the accidental introduction of the bacteria by way of the seeds obtained, another is to scatter on the proposed bed, some soil from a site where nodulated Sturt peas have been successfully grown previously.

These methods of course are rather uncertain, but even complete lack of nitrogen-fixing bacteria may not prevent good growth of Sturt peas in garden conditions, and I have grown good Sturt peas without nodules. Where the garden has been well manured in the past for other plants so that the soil nitrogen level is high, successful growth can usually be achieved without further treatment. If the soil is poor, no nitrogen need be added at planting, but if the seedling plants should become pale and yellowish with no nodules on the dug-up roots (such symptoms not being due to disease as described later) nitrogen in the form of sulphate of

ammonia should be applied lightly at approximately three weekly intervals, according to the growth and flowering of the Sturt peas. Blood and bone can be used as a slower-acting source of nitrogen.

SEED TREATMENT OR SCARIFICATION

This is very important with Sturt peas. The seed purchased in packets or collected in its native haunts, usually contains a high percentage of so called "hard" seeds which, because of an impervious coating, cannot readily absorb the water necessary for germination. Among the methods that can be used to break this impervious coat and give a high percentage of germination, there is the scarification of the seed by rubbing it lightly for no more than one to two minutes between two sheets of sandpaper or emery cloth. This treatment should not be so drastic however, as to cause visible damage or disintegration of the seeds. Another rather more tedious but excellent method is to lightly file each seed with one or two strokes (a nail file will do), or to lightly nick them (without penetration beyond the outside coat) with a razor blade. Both these operations should be performed away from the scar on the seed where it was originally attached to the pod. If you desire to check on the effectiveness of these treatments—it is not strictly necessary—soak the seed afterwards in cold water overnight. Seed, properly treated, will swell but show no sign of damage.

Other pretreatment measures may also be used—for instance soaking the seed in hot (not boiling) water—though personally I prefer the previously mentioned methods as there is difficulty in getting the right control of temperature with the hot water soaking.

METHOD OF SOWING

After the seed has been treated for germination, sowing can be done directly into the beds where the Sturt peas are to flower. The actual distance apart for sowing can be quite variable—for on one hand Sturt peas can individually occupy a large area with carpet-like growth or, when closely planted, make much upward growth. Therefore, seed can be placed up to 18in. apart—possibly with groups of a few seeds at each 18in., with subsequent thinning after germination to give one plant in each position. Or, to get a thick stand, the sowing can be done by dribbling in seeds three to four inches apart in rows about one foot wide, with later thinning if necessary. Thinning can be left until plants seem to be definitely interfering with one another's growth. The depth of sowing should be about ¼in. Germination is rapid and should take place within about a week to ten days. Sturt peas do not like any form of transplanting because of their long tap roots, and only direct sowing where they are to flower is advisable.

Sturt peas grown in author's garden at Maddington

WATERING

Though Sturt peas are desert plants, they often do better when suitably watered, and where grown during the hot dry summer, some watering is essential. The land should be moist, at least immediately under the surface, during germination, and about one watering after planting will be necessary for this. After germination is completed, less moisture is needed, but a good watering can be given about once a week on light soils, or about once fortnight on heavy soils, and even less frequently when cool conditions prevail. Watering can be done by sprinkler if desired, but if signs of leaf burning occur, the water can be more safely applied by running it around the plants in little furrows or holes so that there is no splashing on the foliage.

Overwatering should be avoided, as Sturt peas once germinated, only require moisture in the depth of the soil and there is no need to keep the top surface itself moist continually.

WEEDS

Weeds of any sort should be carefully hoed out as, like other native plants, Sturt peas do not appreciate exotic competition. Care should be taken to avoid damaging the base of the plant as this may encourage diseases.

DISEASES

Sturt peas are not subject to many diseases, but there are some troubles, associated with yellowing and paling of the leaves and general unthriftiness, that sometimes occur. When yellowing or any sudden deaths occur, plants should be dug up and examined. A number of causes can be responsible. If plants are just pale and non-vigorous this may be due to lack of nitrogen-fixing bacteria, which can be confirmed by the absence of nodules on the roots. Application of nitrogen in the form of sulphate of ammonia will help to alleviate this.

At the same time roots should be examined for any further troubles. Yellowing, combined with withering and death of young seedlings, may point to damping-off due to a variety of fungus infections, in which case the base of the plant will be found to be damaged or decayed right through. Over-watering can be a contributory cause to this. Plants already attacked cannot be saved but further progress of the disease can be prevented by watering with a fungicide like Thiram. If the attack is very bad, replanting, preferably on a fresh site, is advisable. If this trouble is persistent, the bed for replanting can be partly sterilised by fire, by Thiram drenching, or by using in the soil various proprietary fungicides which can be purchased for preventing damping-off.

Sturt peas at a later stage are also attacked by the *Rhizoctonia* fungus which may also be involved in the early seedling damping-off. Symptoms are similar to early damping-off with a root or crown root developing as well as severe yellowing of the foliage, with plants wilting rapidly and dying. On examination the base of the stem or part of the roots near ground level shows decay and "ring-barking." Control is similar to seedling damping-off. Excessive watering and poor drainage encourages both these types of complaints.

Finally, there seems to be another form of yellowing and wilting of Sturt peas that occurs in well-grown plants occasionally. It does not seem exactly the same as troubles previously described and no direct reason can be seen in the examination of the roots. Usually plants remain alive, but buds fall off and flowering is reduced. The cause and control of this type of trouble seems obscure, but usually enough plants remain healthy to give a gardener sufficient satisfaction in at least securing some flowers of the beautiful, if sometimes elusive, Sturt peas grown right in his own garden.

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THE COMPLETE BOOK OF MODERN PRESSURE COOKING, by M. B. RUSSELL. Lond., 1949.

COOK IT THE FARMHQUSE WAY, by B. Wilcox. Lond., 1951.

GOOD FOOD FOR CHILDREN, by A. Heath. Lond., 1941.

GOOD HOUSEKEEPING'S COOKERY BOOK. Good Housekeeping Institute. Rev. ed. Lond., 1954.

HANDBOOK FOR HOSTS. "Esquire." N.Y., 1949.

HERBS: HOW TO GROW, TREAT, AND USE THEM, by E. Fearon. Lond., 1953.

HOW TO COOK WITH WINE, by H. Goodwin. Syd., 1954.

INDIAN COOKERY, FOR USE IN ALL COUNTRIES, by E. P. Veerasawmy. Lond., 1936.

NEW AUSTRALIAN COOKERY ILLUSTRATED, edited by W. Reid. Melb. [1950].

THE NEW YORK INTERNATIONAL COOKERY BOOK, by M. Lo Pinto. Lond., 1953.

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CAKE AND BISCUIT BOOK, by M. Patten. Lond., 1952.

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THE COMPLETE BOOK OF HOME PRESERVATION: FRUITS, VEGETABLES, POULTRY, MEAT, FISH AND EGGS, by C. Grange. 2nd ed. Lond., 1948.

THE SCHAUER AUSTRALIAN FRUIT PRESERVING RECIPE BOOK AND CONFECTIONERY, by A. Schauer. 1951 ed. Brisb., 1951.

DRESSMAKING

"McCALL'S" COMPLETE BOOK OF DRESSMAKING, by M. Corey. N.Y., 1951.

MODERN PATTERN DESIGN, by H. Pepin. N.Y., 1942.

TEACH YOURSELF DRESSMAKING, by I. Horner. Rev. ed. Lond., 1947.

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AUSTRALIAN HOME DECORATOR AND PAINTER, by B. H. Brindley. Melb. [1952].

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FURNISHING AUSTRALIAN HOMES, edited by K. Winser. Melb. [1955].

HOW TO MAKE DRAPERIES AND SLIPCOVERS, by E. Brostrom and H. Marinsky. N.Y., 1951.

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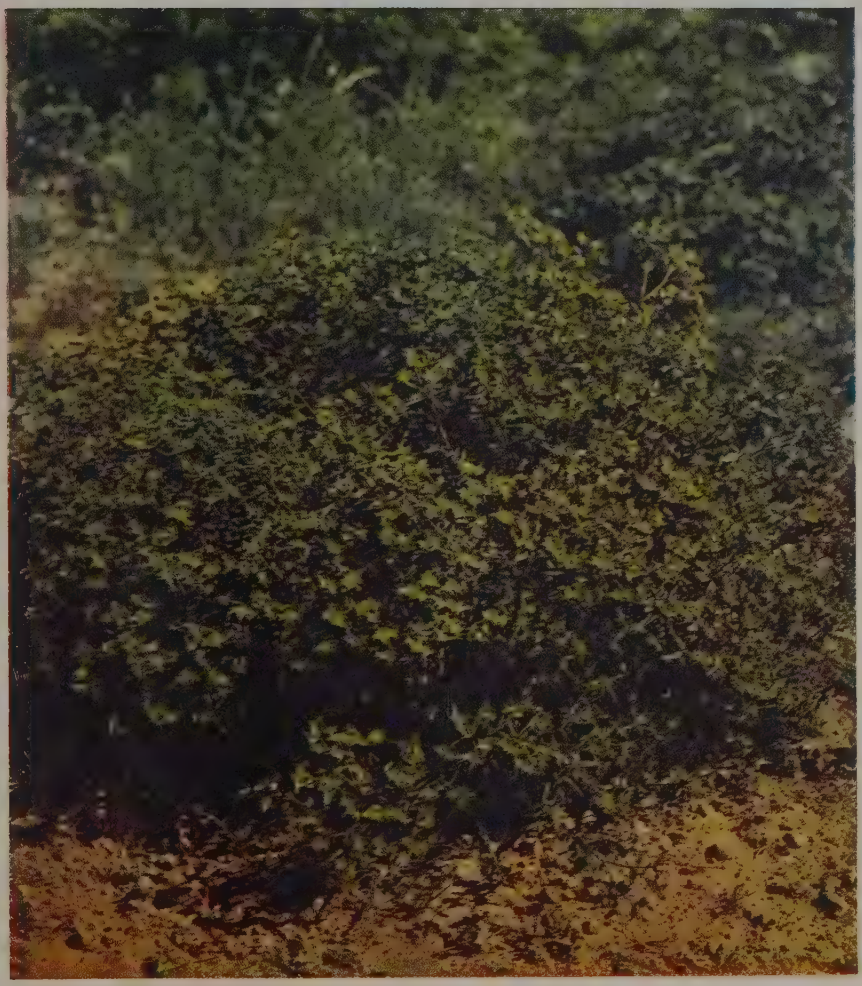


FALSE CAPER OR GERALDTON CARNATION WEED

(*Euphorbia terracina* L.)

Although at present mainly confined to the coastal sandy soils in the vicinity of Geraldton and Dongara, South Australian experience indicates that it could become established at inland centres. Losses of stock in other States have been attributed to eating false caper.

WEEDS of Western Australia

By **G.R.W. MEADLY** M. Sc.
Officer in Charge, Weeds and Seeds Branch

GERALDTON CARNATION WEED OR FALSE CAPER

(Euphorbia terracina L.)

A NUMBER of species of Euphorbia, both native and introduced, occur as weeds in Western Australia. E. Drummondii, known as milk-weed, or mat balsam is a prostrate herb found naturally over an extensive inland area, but being most prevalent in the districts between Carnamah and Northampton. This plant is cyanogenetic as is also another native species, E. boophthona, often referred to as Gascoyne poison or tree balsam. The latter has been responsible for heavy losses of stock on North-West stock routes. The toxicity of the genus has been dealt with fully by C. A. Gardner and H. W. Bennetts (The Toxic Species of the Genus Euphorbia—Journal of Agriculture of Western Australia, Vol. 2—July-August, 1953).

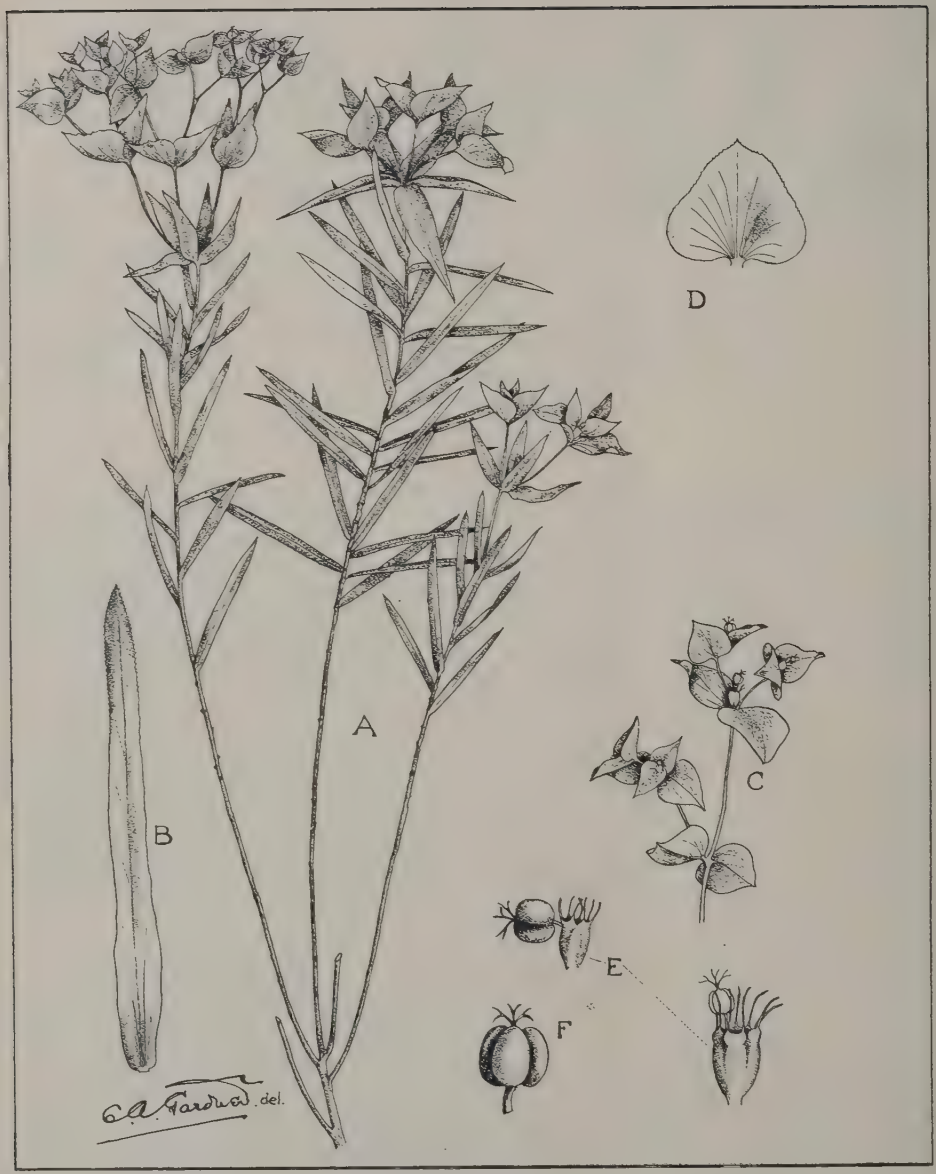
Of the introduced species, several annuals including petty spurge (*E. peplus*) are of little consequence as weeds, but two perennials somewhat similar to one another in habit—*E. segetalis and E. terracina,* have given reason for concern *E. segetalis* has been recorded from several places along the south coast including Albany, Bremer Bay and Esperance, while Geraldton Carnation Weed, as the name implies, is most prevalent in the Geraldton district although also recorded from Fremantle and Esperance.

The date of introduction to the Geraldton district is not known but the Danish botanist, Ostenfeld, recorded that it was common there in 1914. As early as 1903 it was declared to be a noxious weed in South Australia under the name of false caper and apparently had already been established for some time. A recent report from that State reveals that it has spread extensively in the intervening years. It is growing thickly on the coastal and neglected areas of the Adelaide plain from Port Adelaide to Aldinga and one of the worst infestations occurs along the lakes from Wellington to Meningie and in the Narrung district. Bad patches have been noted as far afield as Karoonda, Mannum and Wallaroo districts and it has extended to Eyre Peninsula. Although worst on the sandy coastal soils, it has spread inland and has been recorded more than 100 miles from the coast.

DESCRIPTION

In other States the name, false caper, is in general use and is more appropiate than Geraldton Carnation Weed, for, although the leaves resemble those of a carnation the plants are not closely related. Common names that have been in use for a long time, however, are difficult to change.

The plant is a hairless, leafy, pale green, erect perennial one to three feet in height. The broken stems exude a sticky latex. The stalkless leaves are narrow and three quarters to two inches long with teeth towards the apex. The somewhat inconspicuous inflorescence consists of an



GERALDTON CARNATION WEED
(Euphorbia terracina L.)

A—Habit of plant; B—Leaf; C—Inflorescence; D—Bract; E—Flower Cluster; F—Fruit

(From a pen-drawing by Mr. C. A. Gardner, Government Botanist.)

umbel of four to five rays repeatedly forked. The ovate-rhomboidal bracts each have a short point and are toothed along the edges. The glands are greenish and crescent-shaped with slender horns while the fruits, which are less than on quarter inch long are three lobed and smooth. The seeds are greyish in colour and smooth.

Geraldton Carnation Weed flowers in spring and summer.

SIGNIFICANCE

It is difficult to assess the significance of the weed based on experience in Western Australia, as at present, it is practically entirely confined to poor sandy soils, especially coastal sand dunes. Although it obviously favours the lighter soils we cannot conclude that it will not become established on better soils further inland. South Australian experience shows that this can happen. As already mentioned, in the neighbouring State it occurs more than 100 miles inland and grows vigorously on relatively heavy soils.

Besides possessing the properties of an undesirable perennial weed there is some evidence to show that Geraldton Carnation Weed can be harmful to stock. The fact that disorders are rarely attributed to the plant is undoubtedly due in no small measure to its unpalatable nature although the young growth is sometimes eaten quite readily.

Fortunately the seeds are not specially adapted to facilitate dispersal and most of the spread has occurred along roads where seeds can be carried by vehicles and stock. There is no definite information concerning the longevity of the seeds, but they are likely to remain viable for several years.

CONTROL

Grazing is not a satisfactory method of control as firstly the plant is not attractive to stock and secondly there is always the risk of poisoning if stock are forced to eat large quantities.

On arable land, especially on the better soils, it has been controlled by good tillage but, on lighter soils, particularly where drift is liable, such measures cannot always be undertaken with safety, especially when they involve more than one operation in a year. Under such conditions two alternative methods, competition from vigorous desirable species and chemicals suggest themselves. Perennial veldt grass (*Ehrharta calycina*) has proved an effective competitor, being well adapted to the light sandy soils which favour the growth of the weed. This grass has been used successfully for checking Geraldton Carnation Weed on sandy soils in South Australia.

Two pounds acid equivalent of 2,4-D ester per acre has proved effective. Good results have followed spraying as late as the seeding stage, but in order to prevent seed formation, should be undertaken earlier. The plants also react more readily when making active growth. This method has been used quite extensively for treating Geraldton Carnation Weed on roadsides.

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RAISING TURKEYS

A Guide to Breeding, Feeding and Management

By S. FROOME

Fig. 1.—A hen and gobbler of the Bronzewing variety. Note the desirable body conformation and balance of the hen

IT can be stated, with confidence, that few persons in Western Australia eat turkey meat more than once a year, and many have not tasted it for some years. The majority of households do not include poultry in their usual diet and turkey is on the menu for special occasions only. Although the demand for turkeys by the local market is small, it is seldom that sufficient turkeys are marketed to meet the demand. There are approximately 14,000 turkeys in this State. Only about 4 per cent. of these are found in the metropolitan area, and the remainder are spread fairly evenly over the farming areas.

The turkeys raised in the wheat belt area are, as a rule, allowed open range; the hens make their own nests and brood the young poults under natural conditions. A small number of farmers in the lower South-West have made a special feature of turkey raising and are producing a number of well fleshed birds which bring good market prices.

Little attempt has been made in this State to raise a large flock of turkeys under confined conditions, although this system is becoming popular in many countries where turkeys are raised in quantities.

At the present time the export market is capable of absorbing large quantities of turkeys and as the demand on the local market is seldom satisfied it would appear that further development of turkey raising is justified.

TURKEY STOCK VARIETIES

All turkeys have approximately the same body shape and, although there are a number of varieties, there is only one breed. There are many varieties of domesticated turkeys, all of which are descended from the wild turkey. In the U.S.A. many varieties have developed from the wild stocks native to that country, but the two most popular varieties are the Broad-breasted Bronze and the Beltsville Small-type White. The former has been developed, by careful selection, from the Standard-bred bronze and its increased size is due to more extensive fleshing on the breast and thighs. The latter was developed through cross breeding and selection at the Agricultural Research Centre at Beltsville to meet the needs of the average family.

In Western Australia the majority of the turkey stock is of the Standard-bred Bronze variety and a small number of the White Holland variety. A comparison of the weights of the varieties is given in Table 1.

TABLE 1.

Variety.	Yearling Hen. lb.	Yearling Tom. lb.
Broad-breasted Bronze	20	38
Standard-bred Bronze	18	33
White Holland	16	30
Beltsville Small-type White	12½	24

Fig. 2.—Turkey hens nesting in the bush under natural conditions

A brief description of the desired shape in turkeys of both sexes is as follows:—

Head—appears strong, wide, fairly deep but not coarse.

Beak—strong, medium length, and well curved.

Dewbill or Snood—(The tubular, fleshy appendage at the base of the beak).

—Of the male—Good size and very extensible (4½in. to 6in. when fully extended).

—Of the female—Much smaller and not very extensible (not more than 2in. when fully extended).

Eyes—slightly oval, set well out and appearing alert.

Neck—moderate in length.

Beard—(A cluster of coarse, hairlike feathers attached to the upper part of the breast).

—Of the male—commonly 5 to 7 inches long.

—Of the female—absence is preferred but occasionally reaches 3in. in length.

Wings—strong, good sized, blending smoothly with body plumage, wide overlapping feathers.

Back—broad, well fleshed, sloping downwards in a slightly curved line from front to rear.

Tail—full-fashioned and when relaxed continues the downward curve of the back. When strutting the tail feathers are raised and spread.

Breast—medium length, good breadth, well fleshed, straight or very slightly curved.

Body—as a whole is blocky in appearance.

Thighs—medium length and well fleshed.

Shanks—strong, straight, and of moderate length.

Toes—strong, straight, and well spread.

SIZE OF TURKEYS REQUIRED TO MEET MARKET DEMANDS

Although the weights given previously are desirable for those varieties mentioned it is seldom that large birds are seen on the local market. The demand is for well fleshed birds, not over 12 months of age,

Fig. 3.—Slipped wing:—A wing permanently deformed so that when it is closed the primaries slip down from their normal position under the secondaries

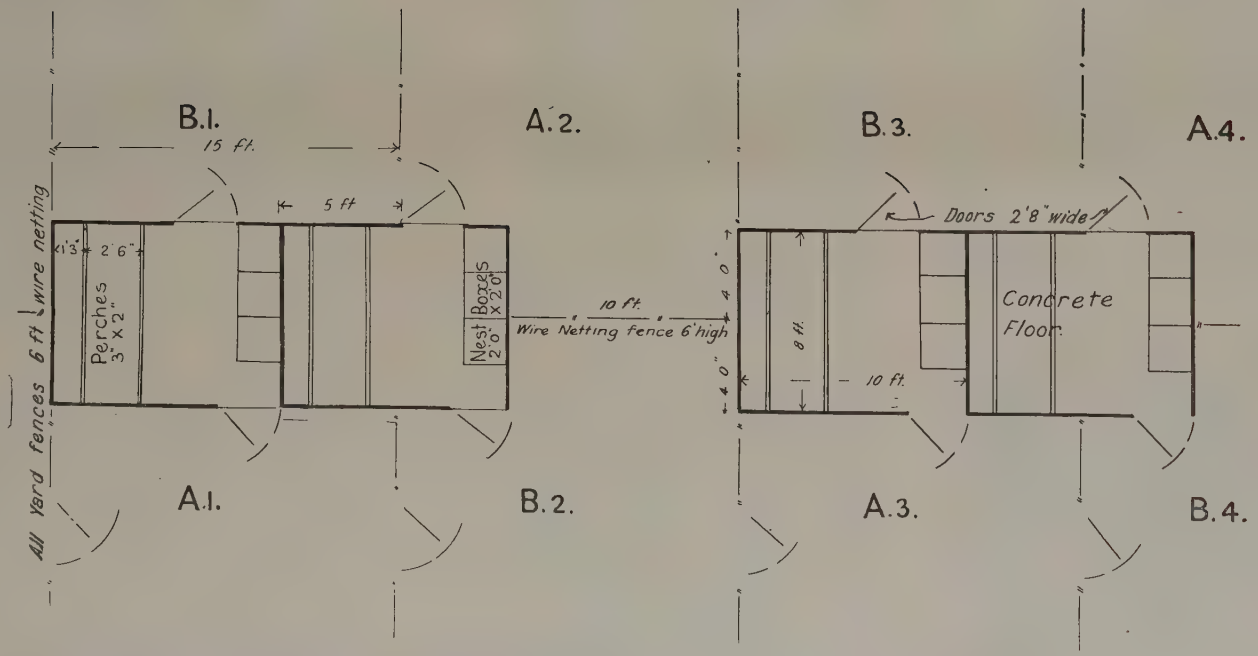

Fig. 4.—Suggested design for sheds and yards for breeding pens. The double yards prevent the males fighting through the wire fences and assists in keeping the yards in a sanitary condition

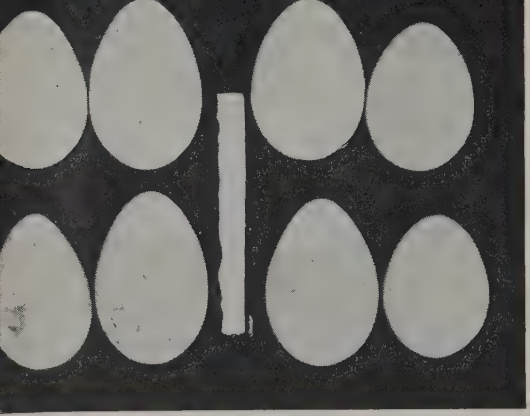

Fig. 5.—Desirable range of weight for eggs for incubation:—Minimum 2½ ozs., maximum 3¼ ozs. The four eggs on the outside are 2¼ ozs. or less and should be rejected. The remainder are from 3 to 3¼ ozs. and are normal in shape. A typical turkey egg of 3¼ ozs. is approximately 2.66 inches in length and 1.9 inches in diameter. (The strip of paper is 4 inches in length.)

the toms weighing 18 to 24 lb. and the hens 10 to 12 lb. This type of medium-sized bird can be produced by any good strain of the Bronze variety already in Western Australia. A turkey breeder in the metropolitan area reports that he has no difficulty in obtaining young turkey toms of 18 to 20 lb. weight at eight to nine months of age and that the hens are ready for market about six weeks earlier at an average weight of 10 to 11 lb.

An article by Mr. A. A. McArdle in the "Journal of Agriculture," South Australia, April, 1949, reports the success of a commercial turkey raising undertaking in that State. The owner originally commenced with Bronzewing turkeys and by selection over a period of years has evolved a hardy, smaller bird carrying ample breast meat. The toms weigh 22 to 23 lb. at about seven months of age when marketed and the hens weigh approximately 14 lb. at the same age.

Table 2 shows the desirable weights to suit local demands at 28 to 30 weeks of age of the varieties of turkeys already mentioned:—

TABLE 2.

Variety.	Female. lb.	Male. lb.
Broad-breasted bronze	15	24
Standard-bred bronze	13	20
White Holland	12	29
Beltsville Small-type White	10	16

When the turkey breeder is selecting his breeding birds he should keep in mind that the consumer requires a medium sized turkey with a well-proportioned body and carrying plenty of meat on the breast and thighs. In a well finished turkey of about 28 weeks of age the edible meat on the breast and thighs amounts to about 65 per cent. of the total edible meat. The large framed bird which is unfattened and carrying little meat on the breast and thighs is not attractive to the consumer and consequently is priced much lower in the markets.

SELECTION OF BREEDERS

The type of bird required by the consumer has already been described but the breeding stock in addition to having good type bodies that are well fleshed must also possess the following characteristics:—Rapid growth and good egg production. These characteristics are inherited, and even in cases where neither time nor facilities are available to carry out a breeding programme it is possible to improve the quality of the progeny produced from year to year by basing the selection of the breeders on these three requirements.

1. **Body Type and Fleshing.**—The best time to select the future breeding stock is when they are 28 weeks of age and when the majority are ready for marketing. At that time they must be up to the weights given in Table 2 and as the width of the breast appears to be the most important factor determining the amount of breast meat it would be advisable for the grower in Western Australia who breeds standard-bred bronze turkeys, to endeavour to obtain the weight given in Table 2 for the Broad-breasted Bronze. The young toms and hens selected should have relatively broad and deep bodies with a good length of keel running parallel with the back and relatively short shanks. The desirable measurements of a young tom, 28 weeks of age and weighing about 24 lb. should be approximately:—Maximum shank length 8.2in. minimum keel length 7.8in. and maximum body depth 9.6in. The corresponding figures for a hen of the same age and weighing 15 lb., are 6.5in., 6.3in. and 7.3in. respectively. The figures given should be used as a guide to desirable conformation but in addition the

A

B

C

D

Fig. 6.—Fast rate of growth is a most necessary requirement of turkey raising. A, B, C, D, illustrate the growth and development of poults at 2, 4, 6 and 8 weeks of age respectively

bird must be well balanced. That is, the legs should be strong, not knock-kneed or bowed, and placed squarely under the body and not so far back that the body tilts forward.

The width and fullness of the breast flesh and the leg fleshing can be determined by handling. The breast should be broad and full along the entire length of the breastbone. The thigh should be plump, well meated towards the hocks and of sufficient size to produce a well-balanced carcass.

Birds that have any serious defect such as pendulous crop, spraddle or crooked legs, deformed back, crooked keels, deformed beaks and crooked toes should be rejected.

2. **Rapid Growth.**—To make a success of turkey raising it is necessary to market the birds as early as possible, therefore, birds and family groups which show a reasonably fast rate of growth should be marked as future breeders. A practical method of obtaining some information on this point is to examine poults each year at about 16 weeks of age. The best developed males and females should be marked. Many more than will eventually be required should be selected because it is most probable that at least 40 per cent. will not qualify as breeders when they are examined just prior to marketing. If the rapid rate of growth shown at 16 weeks has not been maintained the bird should be rejected as a breeder and sent to market.

3. **Egg Production.**—No attempt is made in this article to describe pedigreed breeding work as it is relatively expensive and time consuming, and many turkey raisers do not keep sufficient turkeys to justify the time and expense involved. However, where pen mating is practiced it is possible to keep some records which will assist in the selection of good layers. The hatching period for turkeys in Western Australia is the months of August, September and October. It is difficult to obtain sufficient eggs earlier in the season, and poults do not grow quickly if hatched after the end of October. The turkey raiser should therefore be most interested in the number of eggs the hens lay, in the period June 1 to October 31. Pen records can be kept showing when the hens commenced to lay, the number of eggs laid each day and the number of times any hen became broody.

By marking the poults from each pen, comparing the pen records, and by mating them in family groups the following breeding season, some improvement in egg production may be achieved.

The average egg production, during the period mentioned, of a young hen in her first laying season would be 40 to 50 eggs. The progeny of a hen which goes broody frequently should not be used in future breeding operations, because broodiness is an inherited characteristic and each broody period reduces egg production.

It is not economical to use broody turkey hens to incubate eggs. The object of the hens in the breeding pen is to produce as many fertile eggs as possible during the short hatching season.

BREEDING PRACTICE

Age of Breeding Stock.—Reference has been made to the marking of young turkeys for future breeding stock. For the production of fertile eggs and vigorous poults, well-grown young toms and hens are quite satisfactory. Poults hatched from young turkey hens grow as fast as those from older hens, but it must be realised that the young breeding hens are untested for livability, hatchability and egg production.

Turkey hens usually lay best in their first laying year and as the eggs are produced exclusively to secure poults the higher egg production of young hens results in lower cost per poult hatched. Provided broodiness is discouraged by placing the broodies, as soon as they go broody, in coops with slatted floors, the expected egg production from young hens would be approximately 50 eggs per hen during the hatching season (June-October inclusive).

During the second laying period one would expect 35 to 40 eggs and in her third laying season approximately 30 eggs. Good fertility is usual when well-matured males of about 8½ months of age are mated to selected 8 months old females. If second season hens are used as breeders it is advisable to mate them with young toms as older males are frequently sterile.

Breeding from young stock has the advantage that the majority of the breeding stock can be marketed immediately after the end of the hatching season.

Pen and Flock Matings.—With either type of mating the objective is to secure good fertility as every infertile egg means a loss of money. In pen matings it is usual to use one young tom to 12 hens but better fertility can be obtained by using two toms, that is, use each one every other day. When changing the males the one in the pen should be removed before the second male is introduced. It is advisable to put the toms with the hens about one month before the hens commence laying, as matings appear to be less frequent after laying has commenced. To prevent injury to the backs of females the toe nails of the toms should be clipped every three or four weeks during the breeding season. Although fertile eggs will be secured a day or two after matings have taken place, eggs should not be saved for incubation until 7 days have elapsed. Good fertility will be maintained for two weeks after the toms have been removed and some fertile eggs may be produced for as long as 6 to 8 weeks but fertility decreases rapidly after 14 days. Flock mating is successful when the birds have plenty of range. If they are restricted, the toms spend too much time fighting each other. In a large flock of Bronze turkeys, one tom to 12 to 15 hens can be used provided the males are active birds and not too large and clumsy. At the commencement of the breeding season a reserve of males

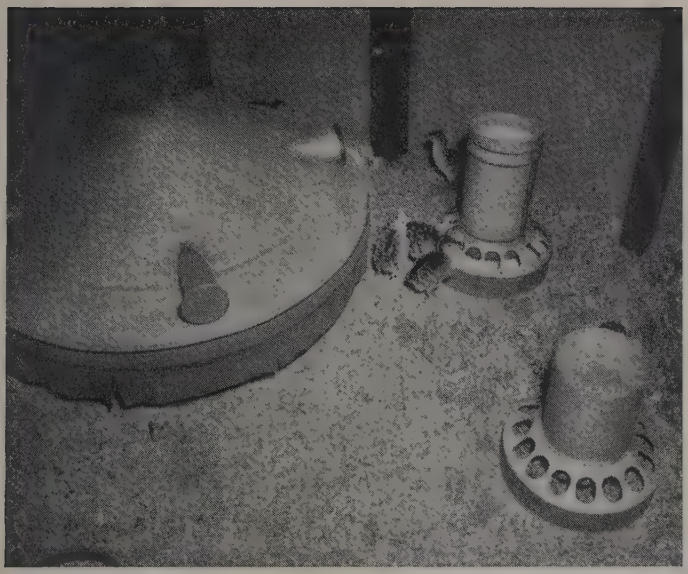

Fig. 7.—Poults can be successfully brooded under the usual type of chicken brooder. Note the types of feeders in use

should be kept as a proportion of the breeding males will be sterile or will not mate for one cause or another. Testing the eggs for fertility after they have been incubated for 9 days, should give an indication of possible fertility, and any male that is likely to produce a low percentage of fertile eggs should be removed and replaced by another.

Fertility is likely to decline in the latter half of the breeding season and a second set of toms should replace the first if good fertility is required late in the season. As with pen mating, the double set of toms could be used alternatively every three days throughout the breeding season. This arrangement should give good fertility for the entire season.

Fertility varies considerably under different conditions and throughout the season, but should not be lower than 83 per cent. Ninety per cent. or better should be the required standard. The hatching season in Western Australia is from the middle of August to the end of October, and it is not uncommon for fertility to be 90 per cent. during this period.

Yards and Houses for the Breeders.—When the system of breeding consists of mating one male with 12 hens, and several such matings are required, it is necessary to provide permanent breeding pens. Although these pens will only be used for six months or less it is most desirable that they be equipped with double yards. An open fronted shed of simple design, 10ft. long by 8ft. from front to back would give ample accommodation. Two perches, each 7ft. long or 3 perches 5ft. long would give sufficient roosting space, and the nest boxes could be placed along one end wall. Open nests about 2ft. square and 1ft. deep, and placed 18in above the floor level will be adequate. Long narrow yards appear to give the best results, each house has one yard in the front and a second yard at the back of the house.

A yard 15ft. wide and 150ft. long will give plenty of room for the breeding stock. A number of yards can be built side by side and by using the front yard of the first pen and the back yard of the second pen and so on, there will always be a vacant yard between the breeding stock. This is a decided advantage as it prevents the males fighting through the fence and any bird which flies over a fence will most probably be found in the vacant yard.

A door in the back of the shed gives access to the back yard. The yards should be sown with permanent pasture grasses and a fortnightly rotation will allow the green feed to recover and the best use of the pasture will be made. The usual yard fences are made of 6ft. wire netting, with additional netting placed to prevent the birds flying on to the houses or tops of gates. The writer has seen breeding pen fences only 3ft. high which the owner claimed were as efficient as the 6ft. fences.

A suggested design for the sheds and yards is shown in Fig. 4. To prevent close contact of breeding stock yards A1, A2, A3, and A4 should be used in the first instance and alternated with yards B1, B2, B3 and B4, at fortnightly intervals.

Care of Hatching Eggs.—Improper care of fertile eggs lowers their hatchability and increases the cost of each poult. Therefore, the selection and care of the eggs to be incubated is important. The weight of individual turkey eggs show a very wide variation, some hens lay eggs which average only 2⅛ oz. while others average 3½ oz. A desirable range for hatching eggs is a minimum weight of 2½ oz. per egg and a maximum of 3¼ oz. In shape, turkey eggs are similar to hen eggs except that the small end is more pointed and as egg shape and weight are inherited it is advisable to select for incubation those eggs which conform to the normal.

Reject all eggs the shells of which are thin or rough and those which have a chalky white porous appearance because, as a rule, they give poor hatchability.

Hatching eggs should be collected in wire baskets three or four times daily and immediately deposited in a cool place. Turkey eggs deteriorate rapidly in hatchability after 14 days holding if the temperature is too high or too low. Temperatures below 35° F. and above 65° F. appear to be most injurious if the eggs are held for more than 10 days before being placed in the incubator. The ideal holding conditions are a temperature of 55° F. with a relative humidity of about 80 per cent. Storing eggs in the well known "Coolgardie Cooler" will be most satisfactory.

Eggs can be stored on their sides or with the small end down and should be turned daily during the holding period.

NATURAL AND ARTIFICIAL INCUBATION

Natural Incubation.—The natural incubation of turkey eggs by using a broody hen or turkey hen is not sound practice, because the broody is out of egg production during the brooding period. However, a short description of the method of setting a broody may be useful. It must be stressed that artificial incubation should be practised wherever possible as it is not always possible to secure broodies at the proper times, and broodies may be carriers of disease to the young poults.

The incubation period for turkey eggs is 28 days. It is advisable therefore to use hens of the heavier breeds which have been broody for at least two days to ensure them sitting for the full period. A nest should be made in a secluded spot by scooping out the soil to make a saucer-shaped depression. A small amount of nesting material is then placed in the hollow. Cover the nest with a suitable box or coop. A nest for a turkey hen should be much larger than one for a fowl and should be about 2ft. square. A broody hen of one of the heavy breeds will cover 8 to 10 turkey eggs but a turkey hen will take 15 to 18 eggs. Broodies should be freed from lice by dusting them with sodium fluoride at the time they are set otherwise the lice may irritate the broody to such an extent that she will desert the nest. If possible two hens or turkey hens should be set at the one time and when all the poults have hatched out they can be given to one of the two

Fig. 8.—A portion of the interior of a brooder house showing a perch in position above the brooder to induce early perching

broodies and the other can be returned to the laying pen. A good sized hen will easily mother 12 poults and a turkey hen can be given 20 to 24.

Water and grain should be always available to the setting hen so that she may feed whenever she leaves the nest.

When the eggs begin to "pip" the front of the nest should be closed to prevent the broody leaving the nest before the hatch is complete. If the bird is quiet the empty shells can be removed from the nest during the hatch. Those eggs not hatched by the end of the 29th day should be discarded.

Artificial Incubation.—Hatching poults in incubators has become the normal method. Among the advantages obtained over natural hatching are:—

(1) The poults can be hatched at the correct time of the year.
(2) There is less labour involved in relation to the number of poults hatched.
(3) Less danger of the poults contracting disease.
(4) The hatching season can be reduced to a shorter period, in which more poults can be produced.

Many types of incubators have been successful in hatching poults and generally the operating conditions for turkey eggs are the same as for hen eggs. In all types of incubators the temperatures suggested by the manufacturer should be closely followed. As a general guide the temperatures in a small incubator should be 100.5° F. for the first week, 101.5° F. for the second week, 102.5° F. for the third week, and 103° F. for the fourth week when the bulb of the thermometer is level with the top of the turkey eggs. With the majority of cabinet-type, forced-draft, incubators the temperature is maintained throughout the 28 days at 99.5° F.

When a separate hatching compartment is used the eggs are transferred on the 24th day and the suggested temperatures vary from 97° F. to 99.5° F. depending on the make of the incubator.

Correct humidity is most important for the successful hatching of turkey eggs. Although the eggs remain in the incubator a week longer than hen eggs they lose slightly less moisture and the poult when hatched weighs about 66 per cent. of the original weight of the egg. To provide optimum conditions for the growth of the embryo the eggs must not lose too much moisture and best results in Western Australia are obtained when the relative humidity is about 60 per cent. during the first 24 days and about 69 per cent. during the last four days. The reader will note this is not in entire agreement with the figures given in Table 3. This is because the figures given above are practical recommendations based on the results of experiments and the table was published by the Smith Incubator Company as a general guide for the incubation of turkey eggs.

The relative humidity should be checked by the wet and dry bulb thermometer readings, but if these facilities are not available a practical guide to humidity is the relative size of the air cell in the egg at different times during the hatch. The air cell being too large at any stage will denote that more moisture is required in the incubator and the reverse will indicate that excess moisture is being maintained. Should the relative humidity of the atmosphere be low during the last four days of a hatch, it may be necessary to lay damp cloths on the top of the hatching trays to obtain the optimum conditions for hatching.

Provided the manufacturers' directions are followed practically all incubators provide adequate ventilation. Any incubator which has given good hatches with hen eggs should give sufficient ventilation for the hatching of turkey eggs.

Experiments have shown that turkey eggs require more turning than hen eggs, in fact in a test, optimum results were obtained when the eggs were turned every three hours day and night for the first 21 days. In practice, turning the eggs five times daily will give good results. The first turning being done early in the morning and the last late at night so that the eggs do not remain unturned for more than about eight hours. Turning after the 21st day does not appear necessary and they must not be turned after the 24th day.

It is usual to test the eggs on the 10th day and remove the infertiles and dead germs. A second test on the 21st day will

reveal eggs containing embryos which have died after the 10th day. These should be removed and the remaining eggs transferred to the hatching compartment of the incubator.

It may be necessary when the hatch is partly completed to remove some of the poults and the empty shells to make room for the other poults which are hatching out. Small type incubators usually have a removable strip at the front of the egg tray to allow the poults to drop into the nursery tray but this strip should not be removed until about one half of the poults have hatched. The nursery tray should be covered with rough surfaced material as poults may injure themselves on a smooth surface.

An incubation chart for turkeys published in "Hatchery Management," by R. C. Hartmen and G. S. Vickers gives concise information on the troubles which occur in incubating turkey eggs and this information is given in Table 3.

BROODING METHODS

Natural Brooding.—If a relatively small number of poults are raised each year it is possible to use hens for brooding purposes. This method has certain advantages as the hen will look after the poults, shelter them from sudden rain storms and in most cases, protect them from attacks by pests. As a rule, the poults have more room than those raiset under a brooder and do not develop the vices of feather

TABLE 3.

Type of Trouble.	Probable Causes.	Indicated Remedies.
Eggs clear after eight to 10 days of incubation	(1) Eggs held too long	(1) Do not hold eggs for more than 10 days before setting.
	(2) Inferior toms	(2) Use vigorous young toms, one for each 12 hens.
	(3) Toms too heavy	(3) Toms should weigh not more than twice as much as hens.
Eggs showing blood traces, or very small embryo when egg is opened	(1) High incubator temperature	(1) Watch incubator temperature.
	(2) Chilled eggs	(2) Keep eggs above freezing.
	(3) Breeding flock out of condition	(3) Proper care and feeding of breeding stock.
Dead Germs. Embryos well developed but dead before pipping shell	(1) Extremes of temperature : either too low or too high	(1) Keep incubator temperature adjusted, avoid overheating.
	(2) Lack of ventilation	(2) Provide fresh air in building, and through incubator.
	(3) Close inbreeding	(3) Avoid Brother-Sister matings.
Too many Help-Outs. Poults well formed but not getting out of shell	(1) Low humidity at hatching time	(1) Increase humidity to 88° on wet bulb when eggs pip.
	(2) Temperature too high in hatching trays	(2) Adjust ventilation so heaters are on very little while eggs are pipping.
Sticky or Drowned Poults. Eggs pipped, but poults smeared with albumen or drowned in egg liquids	(1) Eggs not properly dried down	(1) Keep wet bulb temperature at not over 82° during first 24 days.
	(2) Average incubation temperatures too low	(2) Hold temperatures at 99° on master thermometer.
Hatching too early	(1) Average temperature too high	(1) Hold at 99° throughout hatch.
Delayed Hatching	(1) Average temperature too low	(1) Watch operating temperatures.
Rough Navels. Blood on hatching trays	(1) Temperature too high during fourth week	(1) Avoid overheating from any cause.
Crippled and spraddled legs	(1) Extremes of either high or low temperature, especially during first week	(1) Operate at 99° temperature and 82° wet bulb during first 24 days and 99° temperature and 88° wet bulb during last 4 days.

and toe picking. Because they are raised under natural conditions and not in a heated brooder room the poults appear to be hardy and are more resistant to disease.

A hen which has been sitting on turkey eggs and has hatched out a number of poults can be given extra ones to make up her total to 12.

A convenient way to house the hen and her poults for the first seven to ten days is by means of a coop which is approximately 3ft. x 3ft. in area and has a slatted front. A small run is attached to the front of the coop to which the poults have access between the slats of the coop. The hen remains in the coop all the time. The coop and run should be moved to fresh grass each day. Young poults should not be allowed out on to wet grass until they are at least two weeks of age. Transfer the hen and poults to a larger run when the poults are about three weeks old. A shed equipped with perches should be provided as some poults will commence to perch as early as three weeks of age.

Alternative accommodation to the coop method is a yard enclosed with small mesh netting in which is a shed capable of holding the hen and poults confined for the first three or four days. If a large grassed yard is available poults can remain in it until they are two and one half months of age before going on range.

A point which must be stressed is that turkey poults cannot be raised successfully with chickens, and poults should not be raised on land which has been occupied by fowls because the cecal worms which inhabit the fowl's ceca produce eggs which contain the parasites which cause "blackhead."

Artificial Brooding.—Artificial brooding normally follows the hatching of turkey eggs in an incubator, as it is unlikely that broody hens would be available to brood a large number of poults. Artificial brooding allows a large number of poults to be started at one time which results in a saving of time and labour and a more even flock at marketing time.

Brooder houses and brooders similar to those used in chicken brooding are quite satisfactory, but poults are more difficult to brood than chickens. Brooder management is similar to that used for chickens but with adjustments made to suit poults.

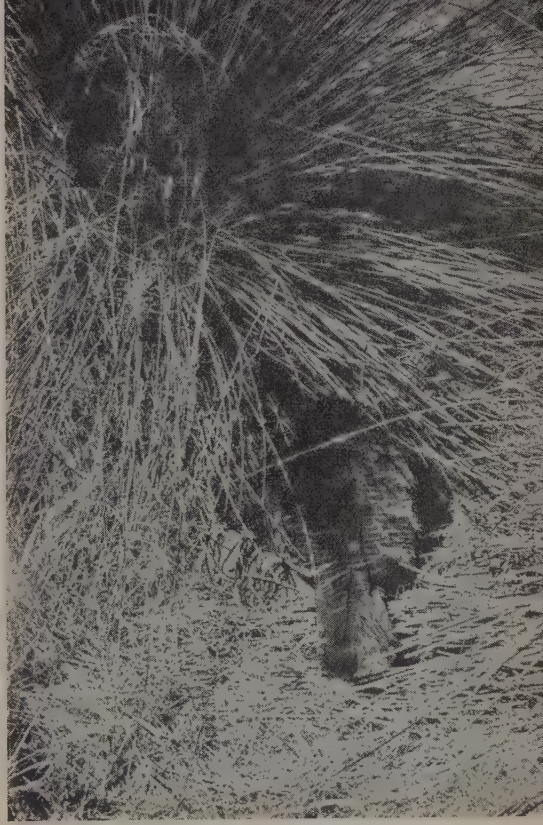

Fig. 9 —Natural incubation. The turkey hen has made her nest in a secluded spot and is incubating the eggs

It is usual to allow 10 to 12 sq. inches of floor space per poult under the brooder and one sq. foot of brooder house floor space. Poults chill and die more easily than chickens so it is necessary to maintain adequate heat under the brooder. The best test of temperature is the behaviour of the poults. If the poults are comfortable they will be active and contented during the day time and at night will be found sleeping around the edge of the brooder. Poults are more subject to fright and crowding than chickens and for this reason it is more satisfactory to brood in small units of not over 100.

Poults will often take fright at any change in equipment and it is advisable to round off each corner of the brooder house with boards or other material to prevent the poults piling up in the corners.

The floor of the brooder house should be covered with dry sawdust to a depth of 4in. which should be stirred every day to keep it in a dry condition, and more sawdust added when necessary.

Wire or slatted wood platforms should be placed under the brooder and under all watering and feeding equipment. Poults require heat for approximately six weeks, the length of time depending on the time of the year and the weather conditions. Early in the brooding season the poults will require heat for a longer period than later in the season when warm conditions prevail.

Perches should be placed in the brooder house when the poults are about two weeks of age and by the time the poults leave the brooder house they should all be perching.

When the poults are ready to leave the brooder house they should be transferred to large grassed yards containing adequate shelter and equipped with perches, feeding and drinking utensils. If the yards are not laid down to permanent pastures it will be necessary to grow a green crop in preparation for the poults.

MANAGEMENT DURING THE REARING PERIOD

There are three distinct systems of rearing turkeys:—

(1) Confinement rearing.

(2) Limited range or semi-confinement.

(3) Free range.

(1) **Confinement Rearing.** — Requires fairly costly equipment but gives better control of soil-borne diseases. It somewhat resembles the intensive system of poultry farming and has similar high capital costs. The equipment consists of a roosting shelter with a rearing platform attached. The platform is exposed to the weather and the turkeys can get into the sunlight. The floors of the shed and platform are built two to three feet above ground level and are made of wooden slats or heavy gauge wire netting to allow droppings to fall through and to give free circulation of air. Six to eight square feet of floor space per bird is required. This includes the roosting shelter and rearing platform. Three sides of the roosting portion are of solid build and feeders and watering equipment are attached to the walls so that they can be serviced from the outside. The sides and roof of the sun platform are ordinary 2in. mesh poultry netting.

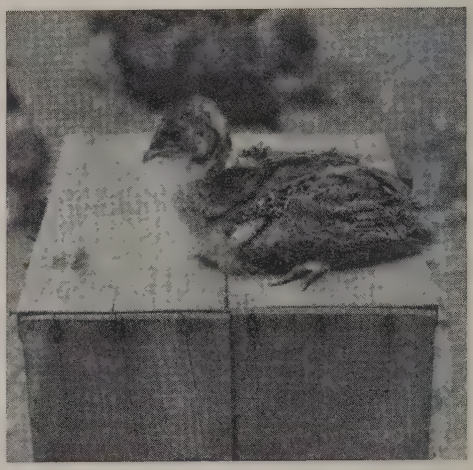

Fig. 10.—This poult is affected with Rickets (Vitamin D deficiency). Leg weakness, awkwardness of gait, softness of the beak and leg bones, and ruffled, unkempt feathers are characteristic of this condition

Feather picking is usually prevalent with this system of rearing and has to be controlled by special devices. The upper beak may be "tipped," that is, about ¼in. of the tip of the beak is cut off with a knife. A pig ring may be inserted between the upper and lower beaks and into, but not through, the nostrils; or a patented "turkey bit" that holds the beak slightly open may be inserted. The confinement method of rearing should be considered where it is desired to rear a large number of turkeys on a small area of land.

(2) **Limited Range.**—This type involves the use of roosting shelters in fenced yards which are large enough to provide most of the green feed. Many adaptations are possible within this system. A portion of a large paddock containing growing green feed can be enclosed by a portable fence; roosting shelters built on skids so they can be easily moved; and feeding and watering equipment made in such a manner that it can be moved every four or five days. An acre of land is required for

200 poults for approximately three to four weeks when the birds should be moved to an adjoining area of the paddock. If the vegetation recovers, the birds can return to the same section of the paddock for another period later in the season, but at least a month should elapse before their return. The watering and feeding equipment should be moved every few days to avoid the vegetation being destroyed and to prevent soil contamination.

Another adaptation of the limited range system of rearing is to build a permanent roosting shed, with a slatted or wire floor and attach to it two, three or four permanently fenced yards. The yards are all laid down to permanent pasture, or sown with green crops and are used in rotation.

When the rearing season is finished the shed and yards should remain empty until they are required the following season. The sheds should be thoroughly cleaned and sprayed, and if the yards are not laid down to permanent pasture they should be ploughed and cropped.

By careful management of the permanent yard system it is possible to rear 400 turkeys on one acre of land each year and maintain the pasture in good condition for the flocks. One shed with roosting facilities for 100 poults should be built on each quarter of an acre of land. Table 4 shows the advantages of the multi-yard system with regard to total yard space per bird:—

TABLE 4.

Square feet of Yard Space per Bird.

(100 Poults on one-quarter of an acre.)

No. of Yards.	Period in each Yard.	Yard Space per Bird per Yard.	Total Yard Space per Bird per 4-week Period.
		sq. ft.	sq. ft.
2	4 weeks	54·5	54·5
3	2 weeks	36·3	72·6
4	9–10 days	27·2	81·6

In each case the poults return to the original yard after it has been rested for four weeks.

(3) **Free Range.**—In the wheat growing areas many poults are reared on open range but some restriction is usually provided to protect the birds and keep them from straying. Roosts are provided near the farm buildings and may be protected by a surrounding fence of poultry netting. If the feeding and watering equipment is placed in the enclosure it will induce the birds to assemble for the evening feed and they can be shut in the enclosure for the night. When a flock of poults roam over a large area they find a proportion of their feed and limited feeding can be practised for part of the rearing period. The feed should be given to the birds in the evening for the reason stated previously. Allowing the birds to roam at will without feeding and protection is not a satisfactory method of rearing except under the most unusual conditions.

Poults can be reared successfully on free range by the use of a small-unit method. A simple shed is provided, sufficient in size to protect 100 poults until they are three and one half months old. Roosts are then built near the shed and a portable netting fence erected to enclose the shed, roosts, and feeding equipment. If feed and water are always available to the birds the units can be placed as close together as 250 yards depending on the amount of green feed growing on the land. The birds are shut up at night but can roam freely during the day.

SOME POINTS OF GENERAL MANAGEMENT

Shade is necessary for turkeys of all ages during hot weather. Where sheds are in use they will give sufficient shade provided they are large enough and can be opened up to allow a good circulation of air. Birds on limited or free range can obtain ideal shade from scattered trees and scrub. A dense area of trees is not desirable as the sun cannot dry out and disinfect the soil, but a scarcity of shade causes the birds to crowd into a small area which is conducive to the development of disease and vicious habits such as feather picking.

Clipping the wings to prevent flying is undesirable but may be necessary to keep the birds confined to their yards. Any tom which is to be used for breeding purposes should not be clipped but the breeding hens can be clipped. The usual practice is to clip about one-half of the outer primary feathers of one wing but an alternative method is to clip the inner seven

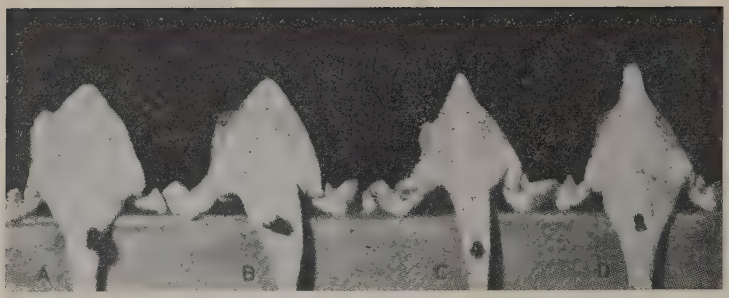

Fig. 11.—"A" and "B" are well-fleshed carcasses which would be graded "prime." "C" and "D" are poorly fleshed and below normal
[S. J. Marsden, Bureau of Animal Industry, U.S. Department of Agriculture, 1940.]

primaries. Clipping should be done when the poults are about 10 weeks of age and again when they are 16 to 20 weeks old.

The sex of a poult can be distinguished with reasonable accuracy at any age from day-old but as the young males do not interfere, to any extent, with the growing females there appears to be little advantage in separating the sexes during the rearing period. Day-old poults can be sexed by the examination of the portion of the sex organs which can be seen in the vent and the same technique is used to sex older poults. As mentioned under the heading "Selection of Breeders" it is desirable to examine the poults for rapid growth at approximately 16 weeks of age when the sex can be determined by the colour of the adult breast feathers which will be partly grown at that age. Females of the Bronze variety will have the breast feathers tipped with white, but those of the males will have dark tips. The body of the male appears to be more angular than the female and has the characteristic male shape. The hocks of the males are broad and flattened and those of the female are narrow and rounded. If the beard is present on the female it is usually smaller, shorter and finer than on the male.

Driving turkeys from place to place on the farm is the best method of transportation provided the birds have been wing clipped to prevent them flying. It involves less labour and is easier on the birds than crating and carting.

Feeding and Watering Equipment.—Poor results will be obtained if feeding and watering equipment are not correct. Poults do not take readily to feed and water and it is necessary to teach them to eat and drink. It is good practice to dip the beak of each poult in water and then in mash as they are put under the brooder.

The first small feed troughs and water vessels should be placed close to and under the edge of the brooder.

These feeders can be open troughs, 2in. wide with 1in. high sides and should be numerous enough to provide 2in lineal feeding space per poult. After the first week larger feeders can be used and by the time the poults are four weeks of age the dry mash trough as used for adult hens will provide satisfactory feeding arrangements.

To maintain the area used for feeding and watering in a sanitary condition it is most desirable to place all the equipment on wire covered platforms, and move to a new position at intervals of a few days.

FEEDING REQUIREMENTS

The feeding of turkeys closely follows the principles recommended for the feeding of chickens, growing stock, and laying hens. Poults show greater relative gains in weight than chickens during the growing period which must be catered for by larger amounts of some of the nutrients in their diet. The objects in turkey nutrition are to produce marketable turkey meat as cheaply as possible or to produce the greatest number of hatchable eggs from the breeding stock. Referring to the first of these objectives the question immediately arises "What is the rate of growth and the feed requirements of poults?" Table 5, which was prepared by L. E. Cline, University of Nevada, shows the average live weights of individual birds at different ages, the amount of feed consumed and the approximate amounts of feed required to produce one pound of gain in weight. The figures are based on

experiments in which the poults received an adequate ration of starting mash, growing mash, mixed grains and green feed. The table shows the uniform gains in weight and food consumption. In actual practice there will be variations but the average for a given period should approximate the figures given.

Points of special interest in the table are:—

(a) A six weeks old turkey weighs 2.45 lb. and has consumed 4.2 lb. of feed.

(b) A 12 weeks old turkey weighs 7.4 lb. and has consumed 18.3 lb. of feed.

TABLE 5.

Age in Weeks.	Average weight of toms and hens combined.	Gain in weight Pounds for Period.	Feed consumed each week.	Pounds total cumulative feed required.	Successive weekly or monthly feed required per pound of gain.
	lb.	lb.	lb.	lb.	lb.
Day old	·12	....	....	....	....
1st	·32	·2	·1	....	....
2nd....	·58	·26	·3	·4	1·1
3rd	·93	·35	·5	·9	1·5
4th	1·4	·47	·7	1·6	1·4
Total	1·4	1·28	1·6	1·6*	1·33
5th	1·9	·50	1·1	2·7	2·2
6th	2·45	·55	1·5	4·2	2·6
7th	3·1	·65	1·8	6·0	2·8
8th	3·86	·76	2·3	8·3	2·9
Total	3·86	2·46	6·7	8·3*	2·6
9th	4·7	·84	2·3	10·6	2·7
10th	5·6	·9	2·4	13·0	2·7
11th	6·5	·9	2·6	15·6	2·9
12th	7·4	·9	2·7	18·3	3·0
Total	7·4	3·54	10·0	18·3*	2·8
13th	8·3	·9	3·0	21·3	3·2
14th	9·2	·9	3·3	24·6	3·4
15th	10·2	1·0	3·5	28·1	3·5
16th	11·2	1·0	3·7	31·8	3·7
Total	11·2	3·8	13·5	31·8*	3·4
17th	12·1	·9	3·9	35·7	4·2
18th	13·0	·9	4·2	39·9	4·6
19th	13·9	·9	4·2	44·1	4·6
20th	14·8	·9	4·3	48·4	5·1
Total	14·8	3·6	16·6	48·4*	4·6
21st	15·7	·9	4·4	52·8	5·1
22nd	16·5	·8	4·4	57·2	5·1
23rd	17·3	·8	4·8	62·0	5·7
24th	18·1	·8	5·2	67·2	6·2
Total	18·1	3·3	18·8	67·2*	5·5
25th	18·9	·8	5·6	72·8	6·8
26th	19·7	·8	6·1	78·9	7·5
27th	20·5	·8	6·4	85·3	8·0
28th	21·3	·8	6·8	92·1	8·5
Total	21·3	3·2	24·9	92·1*	7·7

* Average.

(c) A 24 weeks old turkey weighs 18.1 lb. and has consumed 67.2 lb. of feed.

The average food consumption for 1 lb. gain in weight in the first six-weeks period is 1.7 lb.; in the second six-weeks it is 2.8 lb. and the average for the two periods taken together (first 12 weeks) is 2.47 lb. From the 13th to the 24th week (second 12 weeks period) the food intake shows a rapid increase and 1 lb. gain in weight is obtained from 4.58 lb. of feed.

The different rates of growth in the periods a, b, and c, must be catered for and the proper nutrients must be included in a ration for young growing turkeys.

Recommended Nutrient Allowances for Turkeys.—As previously stated the nutritional requirements of turkeys closely follows those of the domestic fowl and as this subject is adequately covered in the leaflet "Nutritional Requirements of the Domestic Fowl," by R. H. Morris, Department of Agriculture, Western Australia, no good purpose can be served by repeating his work. However, it is necessary to note where differences do occur between the nutritional requirements of hens and turkeys.

Protein Requirements.—Considerable research work has been done to determine the optimum protein content of feeds for growth in turkeys. Table 5 illustrates that as a young turkey increases in age its rate of growth gradually decreases and following along those lines most experiment stations recommend the use of high-protein rations during the first six weeks, but report that satisfactory growth and finish were obtained during later periods on a lower protein level. It would appear that economical gains in weight throughout the growing season can be obtained by feeding a ration of 24 per cent, protein level during the first six weeks, a 20 per cent. level during the second six weeks, followed by a 16 per cent. level until the birds are marketed. It will be noted that the relatively expensive high protein ration is fed when small amounts of feed are consumed and the cost of the ration is reduced as the quantity of feed is increased.

A satisfactory system of feeding is obtained by feeding a 24 per cent. protein starting mash as an all-mash ration for the first six weeks. At the commencement of the second six-week period the protein content of the mash is reduced to 20 per cent. and when the poults are 10 weeks of age the mash is supplemented by gradually increasing amounts of wheat as grain. By the end of the second six-weeks period the poults should be receiving a ration consisting of 60 parts of mash and 40 parts of wheat which will result in the total intake containing approximately 16 per cent. of protein.

Vitamin "A."—The following are the Vitamin "A" requirements for the various classes of stock:—

Chickens—2,000 Int. units of Vit. A per lb. of food.

Turkey poults—4,000 Int. units of Vit. A per lb. of food.

Breeding hens—4,720 Int. units of Vit. A per lb. of food.

Breeding turkeys—4,720 Int. units of Vit. A per lb. of food.

Young turkeys should be given twice the amount of Vitamin "A" per lb. of food than that required by chickens, but breeding hens and turkeys can be treated alike.

Vitamin "D."—Poults have a high Vitamin "D" requirement and will show a deficiency of Vitamin D sooner than chickens. Poults hatched from parent stock deficient in Vitamin D will show a rachitic condition within a few weeks.

The Vitamin D requirements of poultry per lb. of feed are:—

Chickens—180 A.O.A.C. Chick units.

Turkey poults—800 A.O.A.C. Chick units.

Breeding hens—450 A.O.A.C. Chick units.

Breeding turkeys—800 A.O.A.C. Chick units.

Riboflavin.—The symptoms of riboflavin deficiency in poults are different from the symptoms shown by chickens. Poults develop a dermatitis consisting of incrustations at the corners of the mouth and thickened eyelids which tend to stick together. The birds are listless, unthrifty and the growth is very slow.

The recommended amounts of riboflavin which should be fed to poultry are:—

Chickens—290 gamma per 100 grammes of food.

Turkey poults—350 gamma per 100 grammes of food.

Breeding hens—230 gamma per 100 grammes of food.

Breeding turkeys—300 gamma per 100 grammes of food.

Hatchability is markedly affected when the riboflavin intake of breeding stock is below the figure stated.

Calcium and Phosphorus.—In order to prepare a starting mash containing 24 per cent. of protein it is necessary, under Western Australian feeding material supply conditions, to use fairly large quantities of meatmeal which makes it difficult to keep the ration sufficiently low in phosphorus for safety from a perosis standpoint. Good quality meatmeals containing 55 per cent. or more protein are usually relatively low in phosphorus and should be used if obtainable. A starting mash containing not more than two per cent. of calcium and one per cent of phosphorus is considered to be safe but under favourable conditions (when the Vitamin "D" content of the feed is above 160 A.O.A.C. chick units) levels of 0.6 per cent. calcium and 0.6 per cent. phosphorus have given good results.

The level of calcium for breeding turkeys should be 2.25 per cent. and the phosphorus allowance is 0.75 per cent.

It must be emphasised that the above notes on nutrient allowances for turkeys must be read in conjunction with the leaflet previously mentioned.

METHODS OF FEEDING TURKEYS

Rate of growth is not increased when young turkeys range over grassed paddocks or are given an ample supply of green feed, but there is usually a saving of from 10 to 20 per cent. in the total feed cost. Therefore when green feed or pasture is available it should be utilised. Turkeys can be successfully raised on an all dry mash system. The appropriate mash is placed in hoppers or troughs and is available to the birds at all times. Adequate feeding space should be provided; 50ft. of hopper space per 100 turkeys after they are 12 weeks of age will be sufficient.

Complete control of the feeding can be maintained by this method:—The 24 per cent. protein starting mash is placed in the hoppers for the first 6 weeks period; it is then changed to a 20 per cent. mash for the second 6 weeks period, and from the 13th week to marketing the birds are given a 16 per cent. protein mash.

The texture of mashes fed to turkeys should not be too fine as very fine mashes tend to clog in the beak and cause sore mouths. Poults appear to grow and develop better when the ingredients of the mash are coarsely ground. The very fine textured mash is not readily eaten by poults and rapid growth cannot be expected if the food intake is insufficient.

The mash and grain system of feeding appears to be popular, with mash and grain kept in hoppers available to the turkeys all the time. In this system the grain is witheld until the birds are about 9 weeks of age when the mash contains 20 per cent. of protein and as the birds grow they tend to balance their diet. Research work shows that during the growing period poults will consume 40 to 50 per cent. of their total food as grain. The grain can be wheat or oats or both grains fed in separate hoppers. The ration given below could be fed as a starting mash for the first 6 weeks period but it must be noted that a high grade meatmeal or whalemeal must be used to keep down the phosphorus content of the mash.

Ingredient.	lb.	Protein.	Calcium.	Phosphorus.
Bran	20	2·80	0·014	0·120
Wheatmeal....	20	2·00	0·008	0·044
Pollard	20	2·70	0·010	0·064
Gristed Oats	10	0·90	0·005	0·022
Whalemeal (60% protein)	22	13·20	1·100	0·660
Dried Buttermilk	10	3·20	0·130	0·080
Oyster Flour	2	....	0·760	....
	104	24·80	2·027	0·990
	100	23·84	1·949	0·952

At the end of the first 6 weeks period the protein content of the mash can be reduced to approximately 20 per cent. by reducing the meatmeal by 8 lb., that is, to 14 lb. and the dried buttermilk can be reduced from 10 to 4 lb.

The content of the mash would then be:—Protein 20.09 per cent. Calcium 1.721 per cent. and Phosphorus .780 per cent. which can be considered as being within safe limits.

When grain feeding is introduced on the basis of 40 per cent. of the total feed it would be necessary to add 3 lb. of bonemeal and 2 lb. of oyster flour to each 100 lb. of the mash to maintain the level of calcium and phosphorus.

MARKETING

No definite date can be fixed for marketing turkeys, but they should be held until they are in a fit condition to market. Well grown turkeys seven to eight months old should be in excellent condition for dressing, without feeding a fattening ration provided they have been reared on a well balanced growing ration. The turkey grower, having reserved the birds he requires for breeding, should examine the remainder of the flock when they are seven months old and market those birds which are in prime condition. The characteristics of a turkey which would be graded as "prime" are as follows:—

(1) A wide breast carrying plenty of firm flesh. The fleshing must not taper off markedly towards the rear of the keel.

(2) It must be well finished, that is, carry a fair amount of fat in the skin. To determine this it is necessary to examine the skin at a point halfway down the side of the breast just above the front point of the keel and in the sparsely feathered area between the two feather tracts of the breast. A fold of the skin, taken between the thumb and forefinger of each hand, should appear creamy and be approximately $\frac{1}{8}$in. in thickness.

(3) The feathering on the underside of the wing, on the breast and on the drumsticks should be examined. Short pinfeathers cannot be picked clean and with dark coloured plumage part of the feather pigment may remain in the skin. Long pinfeather can be removed fairly easily and will not discolour the carcass. A prime bird should have only a moderate number of long pinfeathers and a few short ones, practically none on the breast.

(4) The flesh on the drumsticks should be well rounded and of normal size. The fleshing should extend well down towards the hock.

(5) No deformities, such as crooked breast, pendulous crop, etc., should be present.

The above requirements are placed rather high in order to give the breeder an ideal to endeavour to obtain. In a well managed turkey flock there are many variations from the normal in breast and leg fleshing. Those birds which are narrow in the breast and are deficient in breast and leg fleshing should be marketed separately from the well fleshed birds as they could not be graded "prime" and their value per lb. would be relatively low.

Care must be taken in the catching, crating and transport to market of the birds as abrasions and bruises lower their value.

ACKNOWLEDGMENT

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(Reprinted from "The Journal of Agriculture," Vol. XXVII (Second Series), No. 4, December, 1950.)

Fig. 1.—Picking export plums on the property of Mr. C. Davey of Pickering Brook. These trees have produced 25 half-bushel cases each for the last four years

THE HANDLING, PRESENTATION AND STORAGE OF STONE FRUITS

By F. MELVILLE, Senior Horticultural Adviser, and

J. S. BLOOMFIELD, Senior Packing Instructor

THE stone fruit industry in Western Australia produces up to 250,000 bushels of fruit per annum. The crop is disposed of mainly as fresh fruit on the local market, but during the last few years a useful outlet for certain varieties of plums has developed in Singapore which imports about 12,000 bushels each year. Stone fruits are not dried commercially and processing is confined mainly to the use of surplus fruit for jam making.

Easily accessible markets are important for the successful disposal of stone fruits, hence a large proportion of the crop is produced in mixed orchards in the Hills areas adjacent to Perth. Considerable areas are also planted in the Donnybrook district, particularly with late varieties, but distance from the market has limited expansion of the industry in that area.

The marketing of stone fruits extends from late November until the end of March. The season opens with early apricots and peaches and the first plums are usually available by the middle of December. January is the main month for stone fruits and a wide range of varieties is available at that time. The better peach varieties such as the Elberta types ripen towards the end of January and supply the demand until well into February. Supplies in late February and March are limited to a few of the later varieties of peaches, nectarines and plums particularly the Ruby Blood. Late canning varieties of peaches are not grown on a commercial scale.

Fig. 2.—Picking containers constructed from 4-gallon tins are ideal for handling stone fruits. The fruit picked directly into the tins in the orchard is not handled again until it reaches the packing shed

With limited outlet for bulk supplies of fruit, the stone fruit grower must depend upon the local fresh fruit market or export trade for the disposal of his produce and as each orchardist packs his own fruit, his success will depend largely on building up a reputation for good presentation and high quality. The postwar development of the Singapore market has enabled some growers to make a specialty of supplying fruit for this trade.

The stone fruit grower is faced with harvesting and marketing problems peculiar to this industry. The picking period for any one variety is relatively short while ripening off the tree proceeds at a rapid rate. During periods of heat wave conditions, ripening is greatly accelerated and when holiday periods intervene or the market is oversupplied then considerable losses can occur. The handling of stone fruits requires considerable skill and judgement.

PICKING

As stone fruits damage very easily, every care must be taken to minimise injury. Stem punctures, finger nail marks and bruising must be guarded against and the less handling the fruit receives, the better. This is particularly important for peaches and nectarines where any type of pressure mark will show up as a deep brown bruise as the fruit ripens. The type of

Fig. 3.—Harvesting Elberta peaches on the property of J. E. Dowell of Bedfordale. A permanent hook on the picking bucket facilitates hanging on the ladder or tree

picking container used is quite important. A shallow rigid picking bucket is ideal and a common type in use is made from a 4-gallon tin fitted with a permanent handle and hook for hanging on the tree or picking ladder. A convenient size is about nine inches deep with the sharp edge turned over all round. One grower has developed a light wooden picking box fitted with suitable handles, which has proved very satisfactory. On no account should any type of canvas bag be used nor should the fruit be piled too deep in the container, or the bottom fruit will be damaged. Tapered buckets are also undesirable. It is advisable to place some type of padding such as woodwool covered with paper in the bottom of the container. In recent years certain growers have marketed peaches in a firm ripe condition and particular care is necessary in handling this class of fruit as it is quite easy to make it unmarketable. One satisfactory method is to use flats open on the side and suitably padded. Only a single layer of fruit is placed in each box and in the packing shed the peaches are transferred directly to the market cases with the minimum of handling.

PICKING MATURITY

In common with most fruits there is an optimum stage of maturity for picking stone fruits but as they ripen rapidly the picking period is very short. There is therefore much less latitude in harvesting than for most other fruits and considerable judgement is required to market the fruit to its best advantage. The degree of ripeness required at picking will depend upon the type of marketing. For instance export fruit or fruit which is subject to long transport must be very firm to stand the length of storage and additional handling. However care must be exercised to ensure that the fruit is not picked when immature otherwise it will tend to lack colour, shrivel and may fail to ripen properly. On the other hand it must be borne in mind that overripe fruit has no market demand and therefore in determining the best stage for harvesting due consideration

Fig. 4.—Export plums being handled on the property of Mr. R. C. Owen of Carmel. Accurate sizing is essential to produce satisfactory packs and with care this can be performed mechanically. Wooden picking boxes designed by the grower can be seen in use

Fig. 5.—A specially constructed elevator in which the rollers do not turn and covered with a canvas sheet prevents stone fruits from marking

must be given to the ripening which will take place during the period from picking to retail consumption.

Meticulous care is necessary in grading plums for export to ensure that the fruit is of even and correct maturity. A few forward plums can spoil the whole presentation. It is not practicable to make one picking and sort into export and local market fruit. A selective picking specially for export is the only satisfactory method.

FRUIT SIZE AND QUALITY

Fruit quality and in particular size has a very important effect on market returns as is shown by the wide variations in prices obtained for different lines of fruit. It is only by giving attention to such factors as size, colour, proper grading, correct maturity and good presentation that uniformly satisfactory returns can be expected. In this regard fruit thinning plays a very important part. Not only is fruit size improved, but the proportion of marketable fruit is increased. It also provides an opportunity to remove fruit damaged by such agencies as pests, diseases, hail and wind before the market stage is reached. Thinning is necessary

Fig. 6.—Apricots should be carefully segregated according to maturity and a practical method of doing this is to pack two cases at the same time from each bin

Fig. 7.—Ripe peaches damage very readily and cannot be handled successfully over a grader. A long bench on which a single layer of fruit is placed is used by B. V. Cross and Sons of Bedfordale for packing local market peaches into open flats

for all varieties of stone fruits and much of the success in growing this fruit lies in the attention given to this operation. Early peaches and apricots and certain varieties of plums which invariably set more fruit than can be brought to commercial size, particularly need attention. From a market point of view fruit size in relation to the variety is the most important factor affecting price.

HANDLING

Cases.

Stone fruits are prepared for market in a variety of ways depending upon the kind of fruit, the size, the maturity and the growers own particular preference, but whatever method is used good presentation will amply repay the effort involved.

The ¾-bushel flat with a central division, is the best all round case and is extensively used for all kinds of stone fruits either as a lidded box or as an open flat. The stone fruit tray is also based on the measurements of the ¾-bushel flat but is only deep enough to take one layer of fruit. Export plums are packed in the half bushel case and this also provides a useful alternative container for the local marketing of plums. With the limited supplies of cherries grown in this State and the high prices offering, the larger boxes are not popular and a number of smaller containers has been tried. Of these a box which is essentially a quarter of a ¾-bushel flat and containing approximately 7 lbs. of fruit has proved very satisfactory. Alternatively a quarter dump case which is slightly larger and contains approximately 10 lb. of fruit can be used.

Fig. 8.—Packing ripe Blackburn peaches and nectarines from flat orchard boxes to open flats for market. This method of handling ripe peaches as used by Mr. S. E. Ward on his property at Kelmscott reduces handling to a minimum. The firmer fruit is segregated for packing into upright ¾-bus. boxes to be lidded for country trade

Stone fruits need some type of case lining material to protect the fruit. For the ¾-bushel flat a good grade white paper is preferable. Newspaper is sometimes used but this greatly detracts from the appearance. Export regulations require corrugated cardboard liners for stone fruit packed in the half bushel box. On the local market either cardboard or white paper should be used.

For the specialised marketing of peaches, trays or open flats are used and as the fruit presented in this way is riper greater precautions are necessary to obviate bruising. The trays contain a single layer of fruit placed on the stem end on a pad of soft woodwool with tissue paper. Green fruit wraps are used by some growers mainly for decorative purposes but the fruit, provided it is good fruit, will show up equally well without such trimmings. Trays are particularly valuable for early peach varieties which tend to soften quickly on the point.

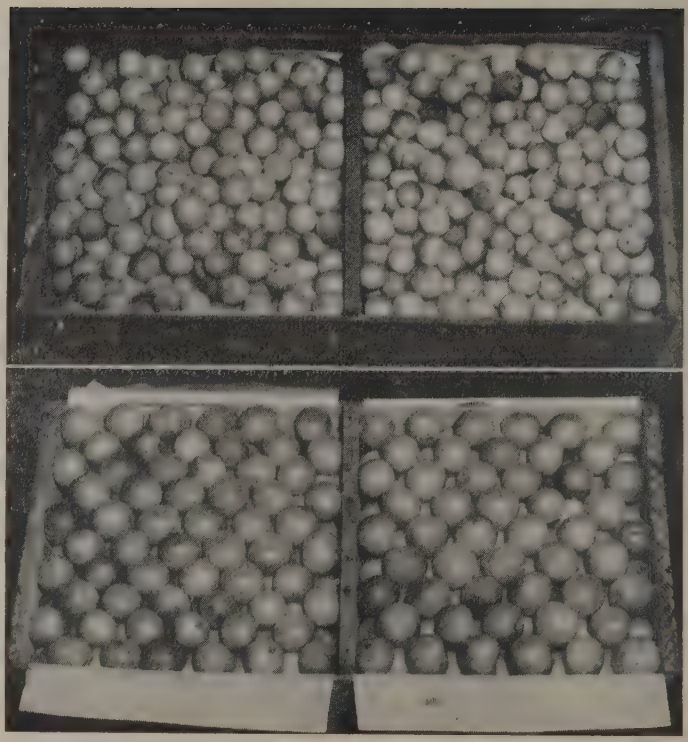

Fig. 9.—An illustration of the value of careful sizing, grading and packing is provided by the wide variation in market prices. The case of apricots at the top of the picture was difficult to sell at 8s., whereas the well presented case (below) was in keen demand at 25s. Fruit not worth packing well is not worth marketing

The ¾-bushel open flat provides the best means of handling high-class peaches and nectarines of the later varieties and considerable success has been achieved in handling fruit in this way. As with the tray it is essential to have a soft quality woodwool pad covered with tissue paper on which two or three layers of fruit are packed diagonally on the cheek.

It must be emphasised that both the tray and the open flat are special packs and require special fruit. They are used for marketing tree-ripe fruit and only first-class peaches and nectarines of large sizes should be packed in this way. These packs are best suited to growers delivering their own fruit to market, due to the careful handling required.

Packing.

All stone fruits should be properly presented for market, that is graded, sized and packed. Poor presentation tends to bring the general price level down. One of the main pitfalls is the inclusion of fruit of different degrees of ripeness in the one case, and this is particularly important in the case of export plums. Every endeavour should be made to pack lines of even maturity, and this means more selective picking. With apricots, even with selective picking it is still necessary to sort into maturity grades during packing. Where the fruit is mechanically sized, it is usual to pack at least two cases of different maturity from the same bin.

Peaches and nectarines, because of their variable shape, do not lend themselves to mechanical sizing but with care apricots and plums can be put over a grader. Only firm fruit should be sized in this way and every precaution taken to minimise bruising. Such precautions include tipping only a small quantity of fruit into the hopper at a time, using a canvas cover on the elevator to prevent the fruit turning, keeping the belt and rollers clean and dressed with talc and frequently removing foreign material such as stalks from the bins. The machine should operate at slow speed and be adjusted so that the fruit will occupy the first few bins to reduce the run of the fruit along the belt. Uniform sizing is very important in obtaining attractive packs in trays.

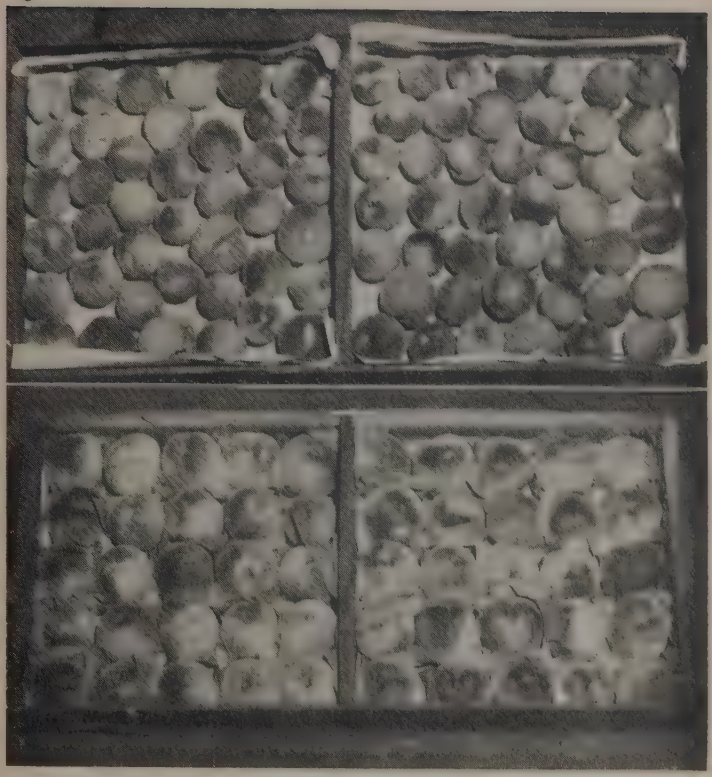

Fig. 10.—Only special fruit should be packed in trays as this is a display pack and will readily show up defects in presentation. This is illustrated by these two contrasting packs

The diversity of packs due to the variability in shape and size of stone fruit varieties makes any detailed discussion of packing or the preparation of packing charts difficult. However there are certain fundamental principles which must be followed. These include correct sizing in order to maintain evenness of pockets for the correct placing of the fruit and packing as firm as possible without causing bruising. Most stone fruits are better presented as straight packs with the exception of a few flat types such as Narrabeen plums, which are packed diagonally.

A good check on the presentation is to remove a side board after the case is nailed down.

The growing of export fruit calls for specialised presentation. The selection of fruit for size and maturity is all-important and particular attention should be paid to the firmness of the pack as the fruit must undergo several weeks storage and transport during which time some shrinkage will occur and there is a danger of the pack becoming slack. Packing charts covering the main export varieties, viz. Santa Rosa, Wickson and Narrabeen plums are available from the Department of Agriculture.

COOL STORAGE

There is a continuity of stone fruits throughout the summer months, varieties following rapidly on one another and often overlapping. There is therefore little opportunity for cool-storing fruit to meet short supplies except towards the end of the season. The main advantage of cool storage is to enable the grower to hold fruit for short periods to tide the marketing over holidays, heatwaves and

temporary gluts. This however is only possible where a grower has his own store or where facilities are close handy. Export stone fruit must also be held in cool store awaiting shipment.

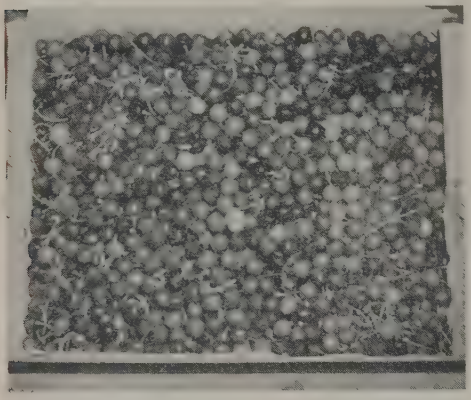

Fig. 11.—Because of the high prices operating, cherries are marketed in small containers. A popular size is one quarter of a ¾-bushel flat containing approximately 7 lb. of fruit

The cool-storage of stone fruits is more difficult than for other fruits and the stored product is never as good as that fresh off the tree. The storage life is also quite short and, unless harvested at the right stage of maturity and handled properly, results can be very disappointing. Peaches and apricots are particularly difficult to cool-store and should be avoided if possible. Where cool storage is essential, then the peaches should be firm ripe and the apricots well coloured, otherwise storage disorders may develop. If immature fruit is cool stored it will fail to develop the juice, flavour or sweetness characteristic of ripe fruit. Peaches become "woolly" or dry. It is not wise to store most varieties for more than two to three weeks. The Elberta type peach is usually the best for storage purposes.

Plums have a somewhat longer storage life than peaches although for most varieties three to four weeks is about the safe limit. Santa Rosas probably store the best followed by Narrabeens. Wicksons are rather subject to browning around the stone, while Ruby Bloods become soft and bladdery. As with other stone fruits the secret of successful cool storage of plums is to pick the fruit at the right stage, that is when definite signs of ripening are obvious. Immature plums will not ripen to an acceptable product.

EXPORT PLUMS

The journey by sea to Singapore is less than a fortnight and therefore it is possible to ship a number of our plum varieties to that destination. The main export varieties are Santa Rosa, Wickson and Narrabeen although there is a demand for Kelsey and certain other varieties in short supply.

From experiments conducted in recent years the optimum picking maturity for the main three export varieties was determined. For Santa Rosas best results are obtained when the skin has developed a light red colour over practically the whole surface of the fruit but before any signs of softening or dark red colour are apparent. In later pickings and in some seasons the colour development is not as good, in which case the ground colour should also be taken into account. The green colour should be showing a definite yellow tinge but not have reached the yellow stage.

Wicksons ripen first on the apex and this serves as a good guide to picking maturity. The skin should show a distinct change in the green ground colour and a slight yellowing should be apparent on the apex. Any fruits developing a blush should be discarded as too forward.

It is rather more difficult to define the optimum picking stage for the Narrabeen variety because of the large variation in colour which is encountered in different districts and different parts of the tree. However good results are obtained with fruit which is well coloured and showing a definite break in the ground colour, and there is a slight give in the flesh. Nevertheless it is essential that the fruit should not be showing any signs of softening.

Export stone fruit should be cool stored as soon as possible after picking. A good procedure is to pick early in the morning while the fruit is still cool, pack during the day and place in cool store late in the afternoon. The important thing is to maintain the temperature of the fruit during the pre-storage period as low as possible. The most satisfactory cool storage temperature is approximately 32° F.

With the short storage life of export plum varieties the pre-shipment storage period must be reduced to a minimum to allow the fruit time to reach its destination and be distributed before its useful life is over.

ACKNOWLEDGMENT

The authors would like to acknowledge the assistance of the many growers who provided material for the photographs and also the Government Photographer who carried out the photographic work.

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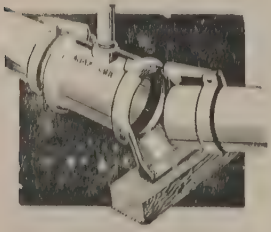

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PARATYPHOID (Salmonellosis) IN SHEEP

By C. R. TOOP, B.V.Sc., Chief Veterinary Surgeon

EXCEPT in imported rams exposed to conditions during transit which had rendered them susceptible to infection, paratyphoid had not until recently been encountered in sheep in Western Australia. During the past few years, however, a considerable number of outbreaks have been reported among flock sheep in the agricultural areas. All of these have occurred during the summer months and some of them have been responsible for serious mortality. It is probable of course that the disease has been present in the State for many years and that it has been confused with other conditions such as entero-toxaemia to which it may in some respects bear a superficial resemblance.

CAUSE

Paratyphoid results from infection with organisms of the *Salmonella* group over 180 closely related species or types of which are known to exist and all of these are able to produce disease in animals, birds and man. *Salmonella typhi-murium* has usually been incriminated in the outbreaks which have occurred among sheep in Australia.

Infection results from the consumption of contaminated food or water and it is most likely to occur during the summer months when water supplies become low and fouled with droppings or when grain or hay fed as a supplementary ration is distributed on the ground. Apparently healthy sheep may harbour *Salmonella* organisms in the intestinal tract and pass them out in the droppings and it is probable in many instances that these "carriers" provide the initial source of infection. Scouring is a prominent feature of the disease and once cases have become established in a flock, infective organisms are voided in enormous numbers in their excretions thus providing every opportunity for the rapid spread of infection by the contamination of pasture and fodder.

In a widespread series of outbreaks which occurred in South Australia in the summer of 1951 investigations revealed that the infection had been spread by carnivorous birds including crows and magpies which had fed upon the carcasses of sheep dead of the disease and had afterwards polluted the water supplies with their droppings. Mice and rats are commonly infected with *Salmonella* organisms, particularly *S. typhi-murium* which may be present in their faeces, and fodder infested with these rodents must be regarded as a danger.

Many outbreaks of paratyphoid have been reported from other States among rams transported long distances by rail, and there have been several mortalities amongst stud sheep consigned both by rail and sea to this State from Eastern Australia. There is evidence to show that prolonged starvation during transit and the considerable period which elapses thereafter before the appetite is fully regained, reduces the resistance of the animals to infection and predisposes them to the disease. There seems little doubt that "carriers" have been present in these consignments and that the contamination of fodder fed from the ground and perhaps water supplies at spelling points where sheep are untrucked for attendance, has played an important part in the spread of infection.

These mortalities have been largely confined to rams running on succulent green pastures before consignment.

SYMPTOMS

Affected sheep become dull and dejected are "tucked up" and cease to feed. The temperature is elevated, respiration is rapid and the eye membranes are red and congested. Scouring accompanied by the passage of yellow or greenish evil-smelling fluid droppings is a prominent symptom.

Death occurs from 24 hours to three to five days of the onset of symptoms and is preceeded by progressive weakness and rapid loss of condition. Mortality rarely exceeds 5 per cent. in flock sheep but may approach and at time exceeds 25 per cent. in rams during and immediately following rail transport.

Many affected animals recover from the disease and may thereafter remain carriers of infection.

Convalescence is prolonged and a period of six to eight weeks may elapse before complete recovery occurs and condition is fully regained.

Where it is desired to confirm the diagnosis a sheep showing advanced symptoms of the disease should be delivered to the Animal Health and Nutrition Laboratory or fresh specimens of liver, kidney, spleen or mesenteric lymph nodes should be submitted for bacteriological examination.

POST MORTEM APPEARANCES

At postmortem examination, inflammatory changes with a variable degree of congestion and reddening of the lining membranes will usually be observed in the fourth stomach and intestines and the associated mesenteric lymph nodes are swollen and contain an excessive amount of fluid. The liver is congested and small haemorrhages may be present on the suface of the heart and beneath the capsule of the kidneys.

PREVENTION

Precautions should be taken against the consumption of contaminated food and water. The water supply should be clean and wholesome and stagnant dams or soaks in which the water has become reduced to a low level should be avoided. Grain fed as a supplementary ration from the ground should be distributed on a clean area and the site of distribution should be changed at frequent intervals. Hay, where practicable, should be fed from racks. Fodder infested with mice or rats should be regarded with suspicion. When an outbreak is in progress sheep with symptoms of scouring should be removed from the flock immediately so as to reduce contamination of the pasture to a minimum and each fresh case as it occurs should be similarly removed and segregated. Under the hot dry conditions of summer the infection is unlikely to survive for more than a few days whereas in moist soil or water it may persist for several months.

Rams intended for transportation over long distances should be removed from succulent pastures and fed a fibrous ration of hay or chaff for two to three weeks prior to consignment and the same bulky ration should be fed to capacity from troughs or racks at spelling points. Feeding from the ground in holding yards fouled with droppings should be avoided and water troughs should be drained and cleaned at frequent intervals. Any animals which develops symptoms of scouring should be removed from the consignment.

TREATMENT

For the treatment of affected sheep, sodium sulphamezathine administered either by mouth or by subcutaneous injection is recommended. The drug is available in a 33⅓ per cent. solution which should be injected in a dosage of 3 ccs. per 10 lb. liveweight on the first day of treatment followed by 1½ cc. per 10 lb. liveweight daily for the next four days. It may also be procured in the form of half-gram tablets to be given by mouth in a dosage of 1 gram (2 tablets) per 10 lb. liveweight on the first day followed by half a gram (1 tablet) per 10 lb. liveweight daily for the succeeding four days. The results of treatment are variable and it is most likely to prove successful if commenced early.

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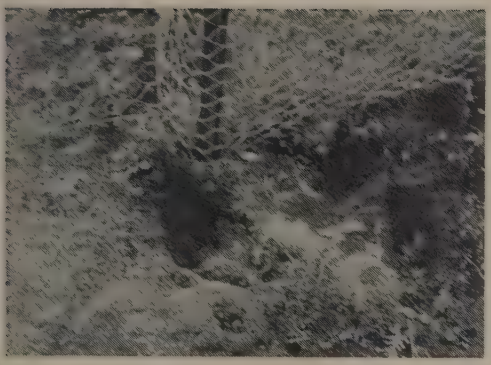

This photograph shows the determined efforts, made by rabbits, to reach the netted-in pasture. Only by constant vigilance were they prevented from burrowing under the netting. Note the differences in growth inside and outside the enclosure

RABBIT DAMAGE TO PASTURE

By C. D. GOODING, B.Sc., Agric.,
Vermin Research Officer.

RABBITS eat a lot of pasture that would be normally available for other more profitable types of livestock. Just how much they do eat we cannot say, although most farmers have their own ideas on the subject. Some farmers maintain that a rabbit will eat (or damage) as much pasture as a sheep; others say that 12 rabbits are needed to equal one sheep. Possibly the true figure lies somewhere between these limits, but if any reader has definite views or recorded observations on the comparisons, I would be glad to hear from him.

It must be borne in mind however, that in special circumstances these figures do not apply. Because a rabbit can graze pasture much more closely than large stock, his effect on the pastures is theoretically equal to that of any number of cattle. Take, for instance, the case of newly-germinated clover at the two-leaf stage. Cattle cannot eat it at this stage, but the rabbits can, and do. Rabbits have, for this reason, often prevented the establishment of clovers when even heavy stocking with cattle would have allowed the clovers to grow successfully.

Take also the damage that rabbits can do to perennial grasses during the summer months. During this period of semi-dormancy, the rabbits can so weaken the plants that subsequent close grazing will eliminate them from the pasture.

SOUTH-WEST EXPERIMENTS

Last year, the Agriculture Protection Board, as a demonstration, fenced off a number of small plots of pasture on different properties in the Manjimup area and kept them under observation.

The plots were only 5 yards x 2 yards in extent and they were subdivided to give two equal areas. From one half, the stock were excluded but rabbits could feed freely. The other half was netted so that neither stock nor rabbits could reach the plants.

The areas were fenced during August, 1954, and the pastures cut in December, 1954. After cutting, the plant material from each section was allowed to dry out and was then weighed to compare the yields.

In areas that were free of rabbits there was naturally no significant difference between the yields of the two halves.

In areas where the infestation was classified as "light," the rabbit-grazed portions of four plots showed losses of 10 per cent., 29.3 per cent., 36.1 per cent. and 47.6 per cent. of the plant material respectively.

In two areas classified as having "moderate" rabbit infestation, the losses were 26.9 per cent. and 32. 9 per cent.

Another two plots in areas of "Heavy" rabbit infestation showed losses of 62.2 per cent and 76.8 per cent., while on two other properties where the infestation was was classed as "Very Heavy" one plot showed a loss of 86.5 per cent. of the pasture and the other was eaten bare—in other words, the rabbits took 100 per cent. of the pasture.

Just so that you can get a clear picture of the losses that rabbits are causing, here are those figures again in tabulated from:

Degree of Infestation.	Pasture Eaten by Rabbits.
Light	10%; 29.3%; 36.1%; 47.6%
Moderate	26.9%; 32.9%
Heavy	62.2%; 76.8%
Very Heavy	86.5%; 100%

Admittedly, this was only a small scale experiment and may not give an entirely true picture. A large-scale trial is ready to commence this year which may give us further information. Nevertheless it shows that the rabbit is costing the industry far more than it can afford to pay.

The actual pasture lost is not the whole story either. It is well-known that where rabbits are plentiful, their selective feeding habits will change the quality of the pasture.

They eat out the tastiest (and these are usually the most nutritious) plants first, allowing the poor-quality plants to take over.

To illustrate this, we made estimates of the composition of the pastures on the four farms listed as areas of "Heavy" and "Very Heavy" rabbit infestation. The percentages were as follows:—

Pasture Species (Open Quadrant).	Farm A (100% Eaten).	Farm B (86·5% Eaten).	Farm C (76·8% Eaten).	Farm D (62·2% Eaten).
Giblett Grass (*Lotus spp.*)	20	95	15	90
Silver Grass (*Festuca spp.*)....	20	....	60	5
Sorrel (*Rumex spp.*)	5	5	10	5
Shivery Grass (*Briza spp.*)	5	..		
Moss	50	....		
Flatweed (*Taraxicum officinale*)	....	....	15	....
Capeweed (*Cryptostemma calendulaceum*)		..	Trace	..

All four properties are situated in the West Manjimup, Yanmah and Dixvale areas, which, in the past have been very heavily infested with rabbits. Last summer they were heavily baited with "1080" and we look to this new poison to give farmers an opportunity to improve their pastures and increase production.

ENGLISH EXPERIMENTS

At this stage, perhaps I may be permitted to digress and give some details of work carried out in England in 1950-52 in an attempt to assess the effects of rabbit infestation in reducing wheat yields.

Taken over six provinces and 119 sites the yield of wheat per acre on the netted plots average 23.6 cwt. to the acre. The yield on the unfenced plots was reduced by 1.6 cwt. per acre. This amounted to an average loss of yield of the order of 6.7 per cent.

On areas where the rabbit damage was described as "Moderate" the reduction was 15 per cent. and on areas where the infestation was described as "Severe" there was an overall diminution in yield of 20 per cent.

RABBIT CONTROL IS IMPORTANT

During the 60 years that rabbits have been present in this State, they have come to be regarded by the average West Australian as a normal feature of our rural scene—and a convenient method of augmenting children's pocket-money during the school holidays.

Landholders have tended to ignore the problem of rabbit control or at least to give it low priority in the list of jobs to be done.

Surely, the figures I have quoted are evidence that rabbit control deserves top priority. Even at a conservative estimate, there must be many farms on which rabbits are eating half the pasture.

Imagine what would be said and done if somebody came on to your property and helped himself to half of your sheep, half your crop, or half of your dairy herd or cream cheque! Yet there are many properties where the rabbits have done this for years. Where is the sense in expend-

ing money on labour, fuel, seed and fertiliser to sow 400 acres of crop when 200 acres will be eaten by rabbits?

Surely it would be a sounder proposition to crop 200 acres AFTER getting rid of the rabbits.

The full impact of "robbery by rabbits" has not been felt during periods of bountiful seasons and high prices attendant upon a "sellers' market."

With the tightening-up which must eventually follow upon the saturation of the world wheat market and increased competition from synthetic fibres, there will be a marked narrowing of profit margins.

Don't wait until reduced profits force you into paying due attention to your rabbit control problems. Get busy NOW before it is too late.

RABBIT CONTROL

Probably as a result of the favourable season and abundance of feed, increased numbers of young rabbits are reported from most agricultural districts.

Field officers report that litters are larger than usual and a number of unoccupied warrens have now been utilised by rabbits moving in from bush country.

The recent wet weather has prevented many farmers from carrying out control work and it is essential that this should be resumed as soon as possible. Even in districts where myxomatosis has reduced the rabbit populations, there is usually a residue of survivors which are already breeding rapidly.

The importance of fumigating and warren-ripping cannot be over-emphasised. The Agricultural Protection Board warren-ripping units, Nos. 2 and 3, have been operating in the Moora district and during October, a total of 373 hours work was carried out on 36 properties. 6

The "1080" poisoning scheme came into operation during November in the Kojonup, Cranbrook, Upper Blackwood, Tambellup, Mt. Barker and Preston districts where 85 per cent. of the farmers have asked to be incorporated into the scheme.

Unconfirmed reports of new outbreaks of myxomatosis have been received from the Oldfield River, Manjimup, Perup and Middlesex areas, and also a confirmed report of an outbreak at Pootenup. An outbreak previously reported from Kulin is spreading over a large area.

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A SIMPLE AID TO FOOTROT CONTROL

By J. A. MALLETT

TWO bags of superphosphate—suitably placed to form a combined seat and sheep-holding cradle—have enabled a Bridgetown farmer to carry out extensive footrot control work with only a fraction of the physical strain which this task usually demands.

The drastic paring and careful examination of every foot of every sheep in the flock is an essential feature of any footrot control measures.

This entails man-handling each sheep into position followed by lengthy sessions of bending and stooping which make severe demands upon the stamina of the operator.

After some hours of foot-paring, even the most conscientious worker is apt to lose much of his efficiency, for his tired feet and aching back are liable to distract his attention from the search for footrot symptoms.

Realising this, manufacturers have designed and marketed several sheep-holding cradles of different types but the cost of some of these models puts them beyond the consideration of small flockowners.

While visiting the property of Mr. W. S. Bagshaw at Bridgetown recently, Mr. Bagshaw mentioned that, after various "trial and error" methods aimed at making the task of foot-paring easier, he had found that two bags of superphosphate leaning at a slight angle against a wall, or against a stack of filled bags, gave excellent results.

The superphosphate was used as it was already in the shed and convenient—bags filled with sand, earth or even sawdust would probably be equally effective.

The bags are placed about ten inches apart as shown in the photograph. A sheep, upended and with its back supported by the bags, will remain in position without struggling, even when it is not held. The operator can sit on one of the bags and pare either the fore or hind feet with a minimum of strain and exertion.

Fig. 1.—Two bags of superphosphate (left) hold the sheep in position for foot examination (right).

Fig. 2.—Stock Inspector J. R. Blackburn demonstrates how the paring of fore or hind feet may be carried out with the operator sitting, relaxed and comfortable, on one of the bags.

Stock inspectors with a wide experience of foot-paring, tell me that this simple device makes the footrot control work at least 100 per cent. easier than the old method of handling the sheep on the shearing floor.

Realising that the avoidance of undue fatigue can play an important part in contributing to the success of the campaign against footrot, we commend this simple device to other farmers who are tackling the disease.

FOOTROT IN SHEEP

The Chief Veterinary Surgeon (Mr. C. R. Toop), reports that farm to farm surveys for the detection of footrot in sheep are continuing, but the work has been greatly retarded by the extremely wet seasonal conditions earlier in the year which, in many cases, made it impracticable to muster and handle sheep for examination.

Seasonal conditions have been extremely favourable towards the spread of footrot, but reports so far received are most encouraging and indicate that a very large proportion of the flocks from which footrot was eradicated in recent years have remained free from infection. Mr. Toop considers that the prospects for the ultimate eradication of footrot from this State are reasonably good.

An inspection of the Geraldton district during September, revealed that 38 out of 40 flocks had been freed from footrot since the eradication campaign commenced four years ago and it was expected that the two remaining flocks would be released from quarantine before the end of December, thus effecting a complete eradication of the disease from an area extending from Mingenew to Northampton and including the Greenough Flats. Although lameness resulting from foot abscess and doublegee penetration was present in many flocks no evidence of infectious footrot could be detected.

The new quarantine yards at Midland Junction have now been completed and came into use on November 7.

All sheep forwarded to Midland Junction under quarantine permit, to be sold for slaughter must now be delivered to these yards, and road vehicles delivering such sheep will be required to be cleansed under supervision, at the washing bay provided.

THE JOURNAL OF AGRICULTURE OF WESTERN AUSTRALIA

Index for 1955 Issues

A

Abydos Station Field Day, 265
Analyses of Feeding Stuffs, 635
Animal Quarantine, 171
Ants—Argentine, 252, 610
Apple Blemishes—Their Causes and How to Control Them, 409
Apples—Loss in Weight of Stored Jonathans, 119
Apples—Pruning Deciduous Fruit Trees, 645
Argentine Ants, 252, 610
Artificial Insemination—Importation of Deep-Frozen Semen, 255
As Cunning as a Fox, 227
Asphodel or Onion-Weed, 529
Asphodelus fistulosus L.—Onion-Weed, 529

B

Bacterial Cultures—Service Discontinued, 203
Bang's Disease or Brucellosis of Cattle, 421
Barley and Oats for the Export Market, 593
Battery Maintenance—Points on, 141
Better Potato Yields, 605
Books for Farmers—Library Board of W.A., 111, 213, 355, 461, 621, 703
Book Review—Fertility and Infertility, 528
Book Review—Farm Animals in Health and Disease, 548
Book Review—Timber in Domestic Building, 559
Book Review—Domestic Fireplaces and Chimneys, 640
Book Review—Methods of Surveying and Measuring Vegetation, 586
Bovine Semen—Importation of Deep-Frozen, 255
Brucellosis of Cattle, 421
Buffel Grass (*Cenchrus ciliaris* L.), 83
Bull Registration, 38
Bush Fires—Protect Your Home Against, 170

C

Cabbage Poison, 193
Calves—Rearing Without Milk, 185
Caper—False, 705
Carnation Weed, 705
Cattle—Contagious Abortion, Brucellosis, 421
Cattle—Preparing Dairy Cattle for Shows, 261
Cattle—Rules of Pure Bred Herd Recording Scheme, 677
Cenchrus ciliaris L.—Buffel Grass, 83
Cereal Variety Trials 1954-55, 205
Ceroplastes destructor Newstead—White Wax Scale, 549
Chemical Trial with Doublegee—A Further—, 229
Chemicals—Damage by Spraying, 301
Chrysanthemums—Commercial Growing of, 599
Cincturing Vines with Hormones, 115
Classing Small Clips, 501
Clay Core Dams, 285
Climbing Cutworm, 75
Clover Disease, 65
Clover Dwalganup—Effect of Hormone-like Herbicides, 457
Clover Seed Production, 228
Coast Disease, 43
Cocksfoots—Two New, Seed Now Available, 325
Cocksfoot—Two Promising New, 157
Codling Moth—Outbreaks Eradicated Promptly, 252
Commercial Chrysanthemum Growing, 599
Contagious Abortion of Cattle, 421
Conservation of Water—Clay Core Dams, 285
Copper and Cobalt Deficiency in Livestock in W.A., 43
Cows—Phosphorus Supplements for, 175
Cows Sweat After All, 640
Cultures—Bacterial—Departmental Service Discontinued, 203
Currant Vines—Effect of Hormone Sprays on Setting, 561
Current Comments on Vermin Control, 381
Cutworm—Climbing, 75

D

Dairy Cattle—Preparation and Handling for Shows, 261
Dairy Cows—Phosphorus Supplements for, 175
Dairying—Rearing Calves Without Milk, 185
Damage by Spraying Chemicals, 301
Damalinia ovis Schr.—Sheep Louse, 98
Dams—Clay Core, 285
Deep-Frozen Bovine Semen—Importation of, 255
Deciduous Fruit Trees—Pruning, 645
Deficiency—Copper and Cobalt in W.A., 43

Departmental Publications—List of, 413
Dingoes and Wild Dogs in W.A., 5
Dingoes—Vermin Bonus System in W.A., 433
Dipping of Sheep—Regulations for, 103
Distemper in Dogs, 589
Dogs—Distemper in, 589
Dogs—Strychnine Poisoning, 583
Domestic Fireplaces and Chimneys (Book Review), 640
Doublegee—Further Chemical Trial with, 229
Doublegee (*Emex australis*), 321
Downy Mildew of Onions, 313
DNC Oil Sprays for Deciduous Fruits, 345
Dwalganup Sub Clover—Effect of Hormone-like Herbicides, 457

E

Eagles, Wedge-tailed—Vermin Bonus System in W.A., 433
Emex Australis—321
Further Chemical Trials with Doublegee, 229
Emus—Vermin Bonus System in W.A., 433
Eucalyptus latifolia F. Muell., 215
Cliftonia, W. V. Fitzg., 216
Foelscheana, F. Muell., 215
lamprocalyx, W. F. Blakely, 216
Euphorbia terracina, 705
Evaporation—Prevention of from Dams, 194

F

False Caper, 705
Farm and Home—
An Apple a Day, 231
Give Your Seams the Professional Touch, 613
Millinery Hood Makes Novel Basket, 124
Novelty Ideas for Sweets, 237
Pressing Woollen Clothes, 451
Removing Fruit Stains, 235
Silver Polishing Cloth, 238
Summer Desserts, 121
"Farm Animals in Health and Disease" (Book Review), 548
Farm Water Conservation—Clay Core Dams, 285
Feeding Stuffs—List of Stock Food and Analyses, 622, 635
Fertilisers—List of Registered, 219
Fertility and Infertility in the Domestic Animals (Book Review), 528
Filing Cases for Journal, 117
Firebreak Erosion—Stop, 585
Flea, Lucerne, 327
Fleece Rot of Sheep—Mycotic Dermatitis (Lumpy Wool) and, 281
Floribunda Roses, 361
Flowers—Floribunda Roses, 361
Flowers—Gerberas Have Many Fine Qualities, 241
Flowers—Sturt Peas for Your Garden, 697
Foot Louse of Sheep, 97
Footrot Control—Sales from Quarantined Properties, 201
Footrot Control—Simple Aid to, 757
Fowls—Leucosis in, 93
Fowl Pox, 473
Fox—As Cunning as a, 227
Foxes—Vermin Bonus System in W.A., 433
Fruit—DNC Oil Sprays for Deciduous, 345
Fruit—Handling, Presentation and Storage of Stone Fruit, 737
Fruit Fly, 378
Fruit Grading—Points on, 492
Fruit—Restrictions on Movement of, 357
Fruit Fly Control—Restrictions of Movement of Fruit, 357
Fruit Fly—New Host Records in W.A., 673
Fruit Pests—White Wax Scale, 549
Fruit—Loss in Weight of Stored Jonathans, 119
Fruit Tree Pruning, 645

G

Gardening—Sturt Peas, 697
Gascoyne Research Station Field Day, 397
Geese—Feeding, Breeding and Management, 533
Geraldton Carnation Weed, 705
Gerberas Have Many Fine Qualities, 241
Getting More from Our Pastures, 609
Grading of Fruits and Vegetables, 492
Grape Vines—Effect of Hormone Sprays on Setting of Currants, 501
Grasses—Buffel, 83
Grasses—Currie and Neptune Cocksfoot Seed Available, 325
Grasses—*Phalaris tuberosa*, 303
Grasses—Two Promising New Cocksfoots, 157

H

Hay—Spring-sown Oats for, 463
Heliothis punctigera Wallengren, 75
Herbicides—Effect on Dwalganup Clover, 457
Herd Recording Scheme—Pure Bred, 677
Hose Level—New Model, 479
Hormones Change Vineyard Practice, 115
Hormone-like Herbicides—Effect on Dwalganup Clover, 457
Hormone Sprays—Effect on Setting of Currant Vines, 561
Horticulture—A Stool-ladder for the Orchard, 405
Horticulture—A Roving Field Day, 669
Horticulture — Commercial Chrysanthemum Growing, 599
Horticulture—DNC Oil Sprays for Deciduous Fruits, 345
Horticulture—Handling, Presentation and Storage of Stone Fruit, 737
Horticulture—Loss in Weight of Stored Jonathan Apples, 119
Horticulture—Pruning Fruit Trees, 645
Horticulture—Restrictions on Movement of Fruit, 357
Horticulture—White Wax scale, 549
Hydraulic Lift and Linkage of Tractors, 389

I

Insect Pests—
- Apple Blemishes and How to Control Them 409
- Argentine Ants, 252
- Climbing Cutworm, 75
- Codling Moth, 252
- Fruit Fly, 378
- Lucerne Flea, 327
- Red Spider, 145
- White Wax Scale, 549
- New Host Records for Fruit Fly, 673

Insecticides—Modern Methods of Applying, 374
Irrigation—Clay Core Dams, 285
Irrigation in W.A.—Government Controlled Schemes, 295

J

Jonathan Apples—Loss in Weight of Stored, 119

K

Kangaroo Control (Woodstock Field Day), 265
Kangaroos—Trapping Yards for, 689
Keds—Lice and Tick in Sheep, 97

L

Lakeland Tomato, 245
Leucosis in Fowls, 93
Lice and Tick in Sheep, 97
Linognathus pedalis—Foot louse of Sheep, 97
List of Departmental Publications, 413
List of Registered Fertilisers, 219
Livestock—Minerals for, 367
Loss in Weight of Stored Jonathan Apples, 119
Lucerne Flea, 327
Lucerne in the North-West, 596
Lumpy Wool, 281

M

Maize Grain Trials at Denmark, 71
Map—Areas for Fruit Movement, 358
Mediterranean Fruit Fly—New Hosts for, 673
Melophagus ovinus L—Sheep Ked, 99
Mesquite Menace, 591
Minerals for Livestock, 367
Modern Methods of Applying Insecticides, 374
Movement of Fruit—Restrictions on, 357
Muresk—Winter Courses at, 360
Mycotic Dermatitis and Fleece Rot of Sheep, 281

N

Noogoora Burr (*Xanthium pungens* Wallr), 33
North-West Field Day (Abydos and Woodstock), 265
North-West Field Day (Gascoyne Research Station), 397
North-West—Lucerne in the, 596
North-West—The Mesquite Menace, 591
North-West—Changes in Pastoral Vegetation as Guide to Management, 683
North-West—Trapping Yards for Kangaroos, 689

O

Oats—Spring Sown for Hay, 463
Oats and Barley for the Export Market, 593
Onions—Downy Mildew of, 313
Onion-weed, 529
Orchard Stool-ladder, 405
Oxalis pes-caprae L—Soursob, 417

P

Paints and Painting—Some Points on, 23
Paratyphoid in Sheep, 373
Paratyphoid (Salmonellosis) in Sheep, 749
Pastures—Potash for, 607
Pastures—Rabbit Damage to, 753
Pastures—Getting More from Our, 609
Pastoral Vegetation as a Guide to Management, 683
Pastures—Two Promising New Cocksfoots, 157
Pedigree Seed—Wheat, Oats and Barley, 675
Pruning Fruit Trees, 645
Pig Forecast, 143
Phalaris tuberosa, 303
Phosphorus Supplements for Dairy Cows, 175
Plant Diseases—Downy Mildew of Onions, 313
Plant Specimens—Points on Submitting, 491
Plant Quarantine, 303
Points on Submitting Plant Specimens, 491
Poison Plants of W.A.—Cabbage Poison, 193
Poisoning—Strychnine in Dogs, 583
Potash for Pastures, 607
Potatoes—It Pays to Use Approved Seed, 605
Poultry Diseases—Leucosis, 93
Poultry Diseases, Fowl Pox, 473
Poultry—Geese, 533
Poultry—Producing Poultry Meat for Profit, 133
Poultry—Turkey Raising, 709
Poultry Sanitation, 335
Preparing Dairy Cattle for Shows, 261
Pressing Woollen Clothes, 451
Protect Your Home Against Bush Fires, 170
Pure Bred Herd Recording Scheme, 677

Q

Quarantine—Animal, 171
Quarantine—Plant, 303

R

Rabbit Control—Use of "1080", 159
Rabbit Damage to Pastures, 753
Raphanus raphanistrum L, 161
Rearing Calves Without Milk, 185
Red-Headed Sheep Louse (*Damalinia ovis.* Schr.), 98
Red Spider, 145
Roses, Floribunda, 361
Roving Field Day, 669
Rules of Pure Bred Herd Recording Scheme, 677

S

Salmonellosis in Sheep, 749
Sanitation—Poultry, 335
Seed Quality, 151
Self-Help in Soil Conservation, 187
Shearing Schools, 113
Sheep—
- Classing Small Clips, 501
- Dipping Regulations, 103
- Fleece Rot of, 281
- Lice and Tick in, 97
- Mycotic Dermatitis and Fleece Rot of, 281
- Parasites, Lice and Tick, 97
- Paratyphoid in, 373
- Salmonellosis, 749
- Shearing Schools, 113
- Simple Aid to Footrot Control, 757
- Vaccines and Vaccination, 252

Shows—Preparation and Handling of Dairy Cattle for, 261
Sminthurus viridis, L., 327
Soil Conservation—New Model Hose Level, 479
Soil Conservation—Self-Help in, 187
Soil Conservation—Stop Firebreak Erosion, 585
Soursob (*Oxalis pes-caprae* L.), 417
Sorghums for Grain and Fodder in the South-West, 465
Spider—The Red, 145
Spinifex Areas—Tackling the Problems of the, 265
Spraying Chemicals—Damage by, 301
Sprays (DNC) for Deciduous Fruits, 345
Spring-Sown Oats for Hay, 463
Stock Diseases—
- Coast Disease, 43
- Copper and Cobalt Deficiency in W.A., 43
- Clover Disease, 65
- Mycotic Dermatitis (Lumpy Wool) and Fleece Rot, 21
- Paratyphoid in Sheep (Rural Radio Talk), 373

Stone Fruit—Handling, Presentation and Storage, 737
Stool-Ladder for the Orchard, 405
Stop Firebreak Erosion, 585
Stock Foods—List of Registered, 622
Storm Damage in Viticultural Areas, 197
Strychnine Poisoning of Dogs, 583
Sturt Peas for your Garden, 697
Subterranean Clover (Dwalganup)—Effect of Hormone-like Herbicides, 457
Sunrise and Sunset Tables, 128, 256, 384, 496, 768

T

Tackling the Problems of the Spinifex Areas, 265
Ticks and Lice in Sheep, 97
Timber in Domestic Building (Book Review), 589
Tomato—The Lakeland, 245
Toowoomba Canary Grass (*Phalaris tuberosa*), 309
Tractor Operation—Wheel Slip in, 39
Tractor Service Hints—Points on Battery Maintenance, 141
Tractor Service Hints—The Hydraulic Lift and linkage, 389
Trapping Yards for Kangaroos, 689
Trees of W.A.—Four Bloodwoods from the Kimberleys, 215
Turkey Raising, 709

V

Vaccines and Vaccination, 249
Variety Trials—Cereal 1954-55, 205
Varnish—Paints and Painting, 27
Vegetable Grading—Points on, 492
Vegetables—The Lakeland Tomato, 245
Velleia discophora F. Muell., 193
Vermin, Bonus System in W.A.—Part 1, 433
Vermin Control—Current Comments on, 381
Vermin Destruction—Wild Dogs and Dingoes in W.A., 5
Vermin—Trapping Yards for Kangaroos, 689
Vermin—Rabbit Control—Use of "1080", 159
Vermin—Rabbit Damage to Pastures, 753
Vermin—Wild Dogs Plentiful, 603
Vine Cincturing with Hormone Sprays, 115
Vineyard Practice—Hormones Change, 115
Viticultural Areas—Storm Damage in, 197

W

Water Conservation—Clay Core Dams, 285
Water Storage—Prevention of Evaporation, 194
Weeds—Damage by Spraying Chemicals, 301
Weeds—Further Chemical Trial with Doublegee, 229
Weeds—The Mesquite Menace, 591
Weeds of W.A.—
- Noogoora Burr, 33
- Onion-Weed, 529
- Soursob, 417
- Wild Radish, 161
- Geraldton Carnation Weed, 705

Western Australia—Irrigation in, 295
Wheat, Oats and Barley—Pedigree Seed, 675
Wheel Slip in Tractor Operation, 39
White Wax Scale, 549
Wild Dogs and Dingoes in W.A., 5
Wild Dogs Plentiful, 603
Wild Dogs—Vermin Bonus System in W.A., 433
Winter Courses at Muresk, 360
Wool—Classing Small Clips, 501
Woollen Clothes—Pressing, 451

X

Xanthium pungens Wallr., 33

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SUNRISE AND SUNSET TIMES FOR JAN.–FEB., 1956

(Supplied by the Government Astronomer)

Times of sunrise and sunset for every fifth day, are given for a number of towns throughout the State. Times for a town not on the list may be estimated if its position in relation to one or more of the listed towns is known. The times given for sunrise are those of the first appearance of the top edge of the sun over a true horizon; those for sunset give the time of the sun's disappearance below a true horizon. Situation in a valley would make the sun appear to rise later, and on a hill it would appear earlier.

SUNRISE

Month.	Day of Month	Broome.	Fort Hedland.	Onslow.	Carnarvon.	Yalgoo.	Geraldton.	Moora.	Kalgoorlie.	Southern Cross.	Merredin.	Perth.	Tammin.	Northam.	Narrogin.	Collie.	Bunbury.	Katanning.	Bridgetown.	Hopetoun.	Esperance.	Cape Leeuwin.	Albany.
Jan.	1	5·19	5·30	5·40	5·38	5·19	5·26	5·15	4·53	5·2	5·6	5·14	5·7	5·10	5·5	5·10	5·12	5·2	5·7	4·52	4·45	5·12	4·57
,,	5	5·21	5·32	5·42	5·41	5·22	5·29	5·18	4·56	5·5	5·9	5·17	5·10	5·13	5·8	5·13	5·15	5·5	5·12	4·55	4·48	5·15	5·0
,,	10	5·24	5·35	5·45	5·44	5·26	5·33	5·22	5·0	5·9	5·13	5·21	5·14	5·17	5·12	5·17	5·19	5·9	5·14	4·59	4·52	5·19	5·4
,,	15	5·26	5·38	5·48	5·47	5·29	5·36	5·26	5·4	5·13	5·17	5·25	5·18	5·21	5·16	5·21	5·23	5·12	5·17	5·2	4·55	5·22	5·8
,,	20	5·30	5·42	5·52	5·52	5·35	5·42	5·32	5·10	5·19	5·23	5·31	5·24	5·27	5·22	5·27	5·29	5·19	5·24	5·9	5·2	5·29	5·15
,,	25	5·33	5·45	5·55	5·55	5·38	5·45	5·35	5·13	5·22	5·26	5·34	5·29	5·30	5·26	5·31	5·33	5·23	5·28	5·13	5·6	5·33	5·19
,,	31	5·36	5·48	5·59	5·59	5·42	5·50	5·40	5·18	5·27	5·31	5·39	5·32	5·35	5·31	5·36	5·38	5·28	5·33	5·18	5·11	5·38	5·24
Feb.	1	5·38	5·52	6·1	6·1	5·44	5·51	5·42	5·20	5·29	5·33	5·41	5·34	5·37	5·34	5·39	5·41	5·31	5·36	5·21	5·14	5·41	5·27
,,	5	5·40	5·52	6·3	6·4	5·48	5·55	5·46	5·24	5·33	5·37	5·45	5·38	5·41	5·38	5·43	5·45	5·35	5·40	5·25	5·18	5·45	5·31
,,	10	5·42	5·55	6·6	6·8	5·52	5·59	5·50	5·28	5·37	5·41	5·50	5·43	5·46	5·42	5·47	5·49	5·40	5·45	5·30	5·23	5·50	5·36
,,	15	5·45	5·58	6·10	6·11	5·55	6·3	5·55	5·33	5·42	5·46	5·54	5·47	5·50	5·47	5·52	5·54	5·44	5·49	5·34	5·27	5·54	5·41
,,	20	5·47	6·0	6·12	6·14	5·59	6·7	5·59	5·37	5·46	5·50	5·59	5·52	5·55	5·51	5·56	5·58	5·49	5·54	5·39	5·32	5·59	5·46
,,	25	5·48	6·1	6·13	6·16	6·2	6·10	6·2	5·40	5·49	5·53	6·2	5·55	5·58	5·55	6·0	6·2	5·53	5·58	5·43	5·36	6·3	5·50
,,	29	5·49	6·3	6·16	6·19	6·4	6·13	6·5	5·43	5·52	5·56	6·5	5·58	6·1	5·59	6·4	6·6	5·57	6·2	5·47	5·40	6·7	5·54

SUNSET

Month.	Day of Month	Broome.	Fort Hedland.	Onslow.	Carnarvon.	Yalgoo.	Geraldton.	Moora.	Kalgoorlie.	Southern Cross.	Merredin.	Perth.	Tammin.	Northam.	Narrogin.	Collie.	Bunbury.	Katanning.	Bridgetown.	Hopetoun.	Esperance.	Cape Leeuwin.	Albany.
Jan.	1	6·30	6·49	7·7	7·19	7·14	7·25	7·24	7·2	7·11	7·15	7·27	7·20	7·23	7·24	7·29	7·31	7·25	7·30	7·15	7·8	7·35	7·26
,,	5	6·31	6·50	7·8	7·20	7·15	7·26	7·24	7·2	7·11	7·15	7·27	7·20	7·23	7·24	7·29	7·31	7·26	7·31	7·16	7·9	7·36	7·26
,,	10	6·32	6·51	7·9	7·20	7·15	7·26	7·24	7·2	7·11	7·15	7·28	7·21	7·24	7·24	7·29	7·31	7·26	7·31	7·16	7·9	7·36	7·26
,,	15	6·33	6·51	7·9	7·20	7·14	7·25	7·23	7·1	7·10	7·14	7·27	7·20	7·23	7·23	7·28	7·30	7·25	7·30	7·15	7·8	7·35	7·25
,,	20	6·34	6·52	7·10	7·20	7·13	7·24	7·22	7·0	7·9	7·13	7·25	7·18	7·21	7·22	7·27	7·29	7·24	7·29	7·14	7·7	7·34	7·24
,,	25	6·33	6·51	7·9	7·19	7·12	7·22	7·21	6·59	7·8	7·12	7·24	7·17	7·20	7·20	7·25	7·27	7·21	7·26	7·11	7·4	7·31	7·21
,,	31	6·31	6·49	7·6	7·16	7·10	7·20	7·18	6·56	7·5	7·9	7·21	7·14	7·17	7·16	7·21	7·23	7·17	7·22	7·7	7·0	7·27	7·17
Feb.	1	6·31	6·49	7·6	7·16	7·9	7·20	7·17	6·55	7·4	7·8	7·20	7·13	7·16	7·15	7·20	7·22	7·16	7·21	7·6	6·59	7·26	7·16
,,	5	6·31	6·48	7·5	7·15	7·7	7·18	7·15	6·53	7·2	7·6	7·17	7·10	7·13	7·13	7·18	7·20	7·13	7·18	7·3	6·56	7·23	7·13
,,	10	6·29	6·46	7·3	7·11	7·3	7·14	7·11	6·49	6·58	7·2	7·13	7·6	7·9	7·9	7·14	7·16	7·9	7·14	6·59	6·52	7·19	7·9
,,	15	6·27	6·44	7·0	7·8	7·0	7·10	7·6	6·44	6·53	6·57	7·9	7·2	7·5	7·5	7·10	7·12	7·5	7·10	6·55	6·48	7·15	7·4
,,	20	6·23	6·40	6·56	7·4	6·55	7·5	7·1	6·39	6·48	6·52	7·3	6·56	6·59	6·59	7·4	7·6	6·59	7·4	6·49	6·42	7·9	6·58
,,	25	6·19	6·36	6·52	6·59	6·49	6·59	6·55	6·33	6·42	6·46	6·58	6·51	6·54	6·52	6·59	6·59	6·52	6·57	6·42	6·35	7·2	6·51
,,	29	6·18	6·34	6·49	6·56	6·47	6·56	6·52	6·30	6·39	6·43	6·54	6·47	6·50	6·48	6·55	6·55	6·48	6·53	6·38	6·31	6·58	6·47